THE

COTTON MANUFACTURE

OF

GREAT BRITAIN

SYSTEMATICALLY INVESTIGATED,

AND ILLUSTRATED BY 150 ORIGINAL FIGURES,

ENGRAVED ON WOOD AND STEEL;

WITH AN INTRODUCTORY VIEW OF ITS COMPARATIVE STATE

IN FOREIGN COUNTRIES,

DRAWN CHIEFLY FROM PERSONAL SURVEY.

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TO

THE MOST HONOURABLE

THE MARQUESS OF LANSDOWNE,

PRESIDENT OF HIS MAJESTY'S RIGHT HONOURABLE PRIVY COUNCIL,

&c. &c. &c.

MY LORD,

THE extensive survey of the industry of nations which I have had occasion to make, both at home and abroad, in composing the following description of its most productive province, has brought before me in auspicious perspective those recent improvements in laws, manufactures, and commerce, which must render the reign of our Gracious Sovereign, King William IV., the golden age of Great Britain.

The Textile Factories, which impart to cotton,

wool, flax, and silk, forms of countless variety and value, had become, in the course of their prodigious development, the subjects of some abuses, and of much unfounded obloquy. Under able Commissioners, selected by the Crown, factory employment was thoroughly investigated, and it has been since placed by Parliament under judicious regulation. Pauperism, that cancer which had long corroded the heart of English industry, and had eventually become so malignant as to be regarded by the ablest economists of Europe beyond the reach of cure, has been skilfully separated from the sound parts of the Commonwealth, and subjected to healing measures, successful beyond the hopes of the most sanguine philanthropist. The reluctant tasks of our Colonial Slaves have been converted into the cheerful labours of freemen. Our complex and restrictive code of fiscal laws has been so simplified and liberalized as greatly to facilitate foreign trade; while the vast empire of China has been made freely accessible to its operations.

These five legislative achievements, which come within the range of my researches, have already given an unparalleled impulsion to manufacturing enterprise, and will shed imperishable glory upon the Statesmen by whose wisdom they were planned and made practically effective.

Of productive industry, thus enfranchised and encouraged, to guide the ingenious toils by the lights of science and the lessons of economy, is my humble aim;—yet not inglorious, should it haply co-operate with His Majesty's Ministers in promoting our country's weal, and ameliorating the lot of humanity.

If the analysis of the cotton machinery and processes, now respectfully inscribed to your Lordship, at all corresponds with my endeavours, or their intrinsic excellence, the work will form the choicest gallery of mechanical invention ever laid open to the world; displaying that mighty system of the production, distribution, and con-

sumption *of national wealth, in its mature state*, of which the elements were first developed in the Political Arithmetic of your Lordship's illustrious ancestor.

I have the honour to be,

My Lord,

With the highest consideration,

Your Lordship's most obedient

And very faithful servant,

ANDREW URE.

London, May 18, 1836.

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INTRODUCTION.

In presenting this long-promised treatise* on the most important and intricate branch of manufactures to the public, I gratefully acknowledge their liberal reception of its precursor volume, and the kind manner in which influential journals of opposite political creeds were pleased to speak of its merits. It was obvious, however, that an inquiry into the factory system of Great Britain must necessarily touch too many delicate topics for an honest expositor to avoid giving offence to certain interests and prepossessions. The contrast which I had delineated, from ocular inspection, between the comfortable activity of our manufacturing operatives, and the listless penury of our agricultural labourers, as well as the hopes I had expressed, since so happily justified, of the improvement among the latter to be looked for from a better administration of the Poor Laws, could be little palatable to that portion of the periodical press, which had vituperated the proprietors of cotton mills, and denounced that legislative Act.

The most vehement maligner of this measure, which promises ere long to heal the heart-sore of English in-

* It was announced six years ago for Dr. Lardner's Cyclopædia, but in the course of completion it assumed a magnitude and style of illustration beyond the limits of that Cabinet Series.

dustry, is well known to be the gentleman employed to criticise the works on manufactures for the Edinburgh Review.* *He* could not be expected therefore to regard my volume with a favourable eye, or to give a fair report either of its tenor or contents. But no one could have supposed that a periodical which had earned so high a character, under the auspices of Mr. Horner, Lord Brougham and Lord Jeffrey, by its able advocacy of public economy, should suddenly become the eulogist of taxes, describe them, with the servile minions of William Pitt, as needful incentives to national industry, and defame a work in which its own liberal principles of trade were conscientiously, though temperately developed.

The title of that book was so worded as to leave no ambiguity, it is believed, in any candid mind, as to its scope.† The phrase Factory System has been long current in our parliamentary debates, newspaper commentaries, and popular harangues. It has been moreover settled and circumscribed three years ago by our Legislature in the *Factories' Regulation Act,* which restricts the term *Factory to such cotton, wool, flax, and silk mills as are moved by steam or water-power.* These establishments alone are placed under the superintendence of four gentlemen, named by the Government, *Factory Inspectors.* From the following cavil, the critic might excite a suspicion, that he had newly alighted, a wondering novice, from some lunar railway, entirely ignorant of the language, laws, and usages of this realm.

* See the Note at the end of this Introduction.

† The Philosophy of Manufactures; or an Exposition of the Scientific, Moral, and Commercial Economy of the Factory System of Great Britain.

"The title of Dr. Ure's book is eminently calculated to mislead. By a factory he means a cotton mill, a flax mill, a woollen mill, or some such establishment in which people are employed to attend to machines continuously impelled by a central power." "Few branches of industry, except such as are conversant merely with spinning and weaving, can be carried on in what Dr. Ure calls factories; and he expressly excludes from them iron-works, dye-works, breweries, distilleries, &c."*

A fine farrago I should have made of that post-octavo volume, had I introduced into it all these heterogeneous ingredients. By excluding from it the things which law and custom had excluded from its title,—Factory System,—I secured unity of design, and a manageable variety of topics. Had the slightest obscurity been left in the title page, the first sentence of the book would have cleared it away. "Manufacture is a word which, in the vicissitude of language, has come to signify the reverse of its intrinsic meaning, for it now denotes every extensive product of art which is made by machinery, with little or no aid of the human hand; so that the most perfect manufacture is that which dispenses entirely with *manual* labour." In fact cotton, wool, flax, and silk mills, the four subdivisions of the factory system, as defined by law, afford by far the finest models of the automatic arts, and form a peculiar group replete with objects eminently interesting in a scientific, moral, and commercial point of view. "And as the philosophy of the fine arts, poetry, painting, and music, may be best studied in their

* *Edinburgh Review for July*, 1835, p. 454.

individual masterpieces, so," said I, "may the philosophy of manufactures in these its noblest creations." If the critic looked at all into my book, he could not have missed seeing these explicit definitions in its first and second pages, when, even supposing him to have been an unfledged tyro, he was left without the shadow of a reason, or the slightest pretence, for declaring its contents to be irrelevant to its title.

In the first chapter of that work, the general functions of machines are discussed, and several valuable facts are detailed respecting mill architecture, communicated to me by one of the most eminent engineers of the age. The influence of improvements in machinery, upon manufactures and trade, are investigated at some length, as well as the effect of patents in keeping up new inventions at a monopoly price, so as to retard their general introduction, and prevent those abrupt transitions from hand-labour to automatic work which would be apt to throw operatives for a time out of employment. As to the details of machine-making they belong to a treatise upon mechanics, and would be strangely misplaced in one upon the philosophy of manufactures. Had I entered more largely into the subject of machinery, to suit the reviewer's caprice, I should have been obliged to sacrifice inquiries much more appropriate to the title of the work and the wants of society.

The second chapter of the first Book of that volume, entitled "Topography and Statistics of the Factory System," is dedicated to the solution of the problem why manufactures flourish more in one district than another. Here the influence of cheap fuel, an abundant population, commodious seaports, streams of pure water, in-

land navigation, the energy of capitalists, a ready supply of the raw material, are severally specified as elements of our factory greatness.

Even the first page of the preface contains a summary of the circumstances upon which the manufacturing superiority of this country over the other European States depends. It is there said, "Great Britain may certainly continue to uphold her envied supremacy, sustained by her coal, iron, capital, and skill, if, acting on the Baconian axiom, 'knowledge is power,' she shall diligently promote moral and intellectual culture among her productive population." Yet the critic, under his anonymous mask, is so wantonly reckless of truth as to say, "If any one were to inquire why the factory system had not been carried to the same extent in France or Austria as in England, he will get no answer from Dr. Ure."

But his most flagrant misrepresentation is accusing my book of being "singularly defective on the influence of manufactures on the health and happiness of the individuals engaged in them."* Now I defy even a purblind man to glance over its leaves in the most casual way without perceiving that fully one-third of them is occupied with a methodical exposition of the moral economy of the factory system, distributed into three distinct chapters, entitled, 1, Comforts of Factory Operatives; 2, Health of Factory Inmates; 3, State of Religion and Knowledge in the Factories,—subjects occupying no fewer than 152 pages successively headed with these titles. Nor is there a single topic alluded to by the reviewer in his pretence to

* *Edinburgh Review for July*, 1835, p. 455.

supply my deficiencies, which is not deliberately discussed, with copious proofs and illustrations, many of them original, in that very work which he set himself rashly to revile, in despite of candour and consistency.*

In attempting to vindicate the factories from many misrepresentations, I have never shut my eyes to special abuses of any kind, nor have I tried to varnish them over in my narratives. When the reviewer charges me with saying that the statements as to the pernicious influence of factory labour have been proved to be *wholly* destitute of foundation, he himself is the only person who says what is *wholly so,* for I was most solicitous to discriminate between the comfortableness of a factory when administered by a humane and religious proprietor, and by one of a careless or corrupt disposition; and I have reason to believe that my general strictures on this delicate point, as they were prompted solely by regard to my fellow-creatures, have already tended to introduce ameliorations into certain establishments.

In reference to the health of our factory inmates, nothing has come to my knowledge since the publication of the Philosophy of Manufactures which should make me retract my opinion, that employment in a cotton-mill may be, and generally is, as salubrious as any other which the children of labour can obtain in the present state of the world. I should wish, however, to see warm-baths attached to every cotton-

* The book was only a few days out when the Reviewer's poisoned dart came hissing after it, to cut short its career—*imbelle telum.* The second edition is already several months on sale. A translation of the work has appeared under the patronage of the French Government, with high commendations; it has come forth also in a German dress.

factory. They could be supplied without trouble or expense with the pure hot water discharged from the steam pipes which traverse the apartments. A set of such baths for males, and another for females, at opposite sides or ends of the building, each kept in order by a superannuated man and woman, who would receive a trifle from each bather for their attendance, would conduce greatly to the cleanliness, health, and comfort of the operatives. "When the perspiration," says an eminent physiologist, "is brought to the surface of the skin and confined there, either by injudicious clothing or want of cleanliness, there is much reason to suppose that its residual parts are again absorbed, and act on the system as a poison of greater or less power, according to its quantity and degree of concentration, thereby producing fever, inflammation, and even death itself; for it is established by observation that concentrated animal effluvia form a very energetic poison.

"If one-tenth of the persevering attention and labour, bestowed to so much purpose in rubbing down and currying the skins of horses, were bestowed by the human race in keeping themselves in good condition, and a little attention were paid to diet and clothing, colds, nervous diseases, and stomach complaints would cease to form so large an item in the catalogue of human miseries. Man studies the nature of other animals, and adapts his conduct to their constitution—himself alone he continues ignorant of and neglects; he considers himself as a being of a superior order, and not subject to the laws of organization which regulate the functions of the inferior animals; but this conclusion is the result of ignorance and pride, and

not a just inference from the premises on which it is ostensibly founded."*

Mr. Rickman, the able editor of the Parliamentary Population Returns, in an interesting communication published in the *Medical Gazette* of December 19, 1835, shows that the average mortality of females between ten and twenty years of age, in the four non-factory counties, Bedford, Bucks, Northampton, and Rutland, is annually one in 133; but in Lancashire, and the West Riding of Yorkshire, the two chief factory counties, only one in 172 for the first, and one in 177 for the second. He then observes, "I never yet could discover any fact which was likely to place the health of the manufacturing population below that of other occupations, nor have I ever met with any alleged fact to that effect which stood the test of strict examination; so that, in the conflict of opinion, I was bound to adhere to equality of health in the grades of female life (from ten to fourteen, and from fifteen to nineteen years) which chiefly constitute our manufacturing population. Moreover, I was the less prepared to discover disadvantage to young females in the counties of Bedford and Bucks than elsewhere, because in my youth I had traversed those counties oftener than once in pedestrian excursions, and was then much struck by the happy appearance of young girls and other females sitting at cottage doors or with open windows, busied in lace-making, especially as constant shelter from bad weather had preserved their beauty, so as to equal that of highly educated females.

"It is impossible to investigate retrospectively whe-

* *Principles of Physiology*, by Andrew Combe, M.D., pp. 67, 101.

ther in earlier times, in the days of Queen Elizabeth for example, the sedentary occupation of the *spinster* (which included all unmarried females, and is still their legal designation) had the same deleterious effect as in the four selected counties; if so, females are *positively benefited, not injured, by the introduction of machinery,* as well-meaning philanthropists too readily suppose; for I cannot imagine or believe that regular hours of labour, plenty of fuel, good clothing, and the many other comforts which spring from high wages, are injurious to the health of any human being. We all know but too well from the incessant clamours of hand-loom weavers, that there are many industrious men who, during a series of years, have carried on a domestic manufacture in small rooms, crowded by looms and weaving apparatus, breathing air loaded with dust, their hours of labour extending into the night, payment for such weaving very moderate,—preferring all these inconveniences to factory labour, because they cannot endure stated hours and the regular behaviour indispensable in every factory; nor do they send their children thither, because they are retained at home to prepare hand-loom work.

"The female mortality of the above four non-factory counties exceeds that of their males between the ages of ten and twenty in the ratio of 100 to 68, and female life in Westmoreland has the same unhappy bias. In Lancashire and the North Riding of Yorkshire the scale is rather in favour of females, female deaths to male deaths being in the former as 100 to 104, and in the latter nearly equal."

The professor of political economy blames me for not expatiating on the benefits which our taxation

has conferred on our manufactures. "An increase of taxation," says he, "is one of the most prominent causes of an increase of wages, and, independent of this direct influence on the manufacturer, is precisely similar to an increase of wages." What confusion of ideas! What contradiction of terms! So that because the manufacturers by direct influence first suffer from taxation as they would do from increase of wages, and have besides to pay their workmen increased wages from that "most prominent cause," taxation, they should congratulate themselves on being stimulated by such agreeable incentives to industry, while the *torpid manufacturers of the United States, who are now supplanting us in many foreign markets, are unfortunately destitute of these double-strong cordials.*

Nor was political economy overlooked in treating the philosophy of manufactures, as the critic would insinuate. Through every division of the book there flows a stream of that useful science, drawn from its purest fountains;* not, indeed, from those noxious pools where absenteeism, pauperism, and taxation are set off with the flowers of sophistry. Nurtured in the severe studies of physical science during a laborious life, I have been careful to search for truth, unbiassed by motives of place-hunting or political partisanship, happy if I can be of some little use to mankind in my day and generation.

In what light our manufacturing classes view taxation the following details will show.

The repeal of certain additional duties imposed by

* The speeches of Mr. Huskisson, *inter alios.*

Mr. Pitt in 1784 upon printed calicoes, was celebrated as a jubilee in Lancashire; and when the two gentlemen delegates to London, who had been particularly active in the application to Government, returned to Manchester, they were honoured with a triumphal reception, being met by a procession of all classes of people, which extended to Stockport, a distance of no less than seven miles—the most joyous and brilliant exhibition ever seen in that emporium of industry. The inhabitants of Manchester and Bolton combined to present handsome silver cups to these gentlemen, with suitable inscriptions.

Their ground of rejoicing was soon, however, taken away by the wants of the Exchequer, drained by the culpable expenditure of the American war, and heavy duties were imposed, which continued to cripple and annoy the elegant art of calico printing till 1831, when they were repealed; since which period, the business has more than doubled in extent. This repeal is one of the most judicious acts of modern legislation. It enables the consumer to get the article from 30 to 40 per cent. cheaper, and females of the lower ranks to clothe themselves in handsome comfortable dresses, such as their superiors previously wore. The taxed goods, which in 1795 were sold for 2*s.* 3*d.* a yard, now cost no more than 8*d.* A respectable dress may in fact be had at present for half a crown. The suppression of the tax has been further beneficial to the honest manufacturers by extinguishing the contraband trade, which had been carried on to an extent equally injurious to them and to the revenue. Another advantage of the repeal was, freeing a business, involving so much taste, skill, and science from the insolent and venal *espionage* of

poorly paid excisemen, who were easily bribed to steal secret processes which had cost great toil and expense to the proprietor, and sell them to jealous rivals.

Nor is it a matter of slight moment for a manufacturer to have the distribution of his own time and operations. He is now suffered to print his goods at any hour of the day in which he receives an order, instead of being obliged, as he formerly was, to wait for the arrival of the officer to measure and stamp the cloth, before he dared begin to pack it in bales for the market. Under the critic's *stimulus* of taxation, adventurers often bought printed calicoes on credit, and forthwith sent them abroad to raise a capital by the drawback, for carrying on a nefarious system of trading far beyond their legitimate means. Such goods were of course hurried off to foreign markets for which they were neither wanted nor suited, and caused disastrous competition, by their forced sales, against the responsible merchant.

Had not our cotton manufactures been cramped by taxation, they would long ago have acquired such a surpassing power as to have bid defiance to foreign rivalry. Goods would have been profitably produced by our admirable automatic machinery, guided by a comfortable and well-informed race of artisans, at such moderate rates as would have rendered all attempts at competition utterly hopeless; whereas they have been kept up by taxation of every kind, and by the discontents, conspiracies, and strikes among the operatives, mainly caused by taxes on the necessaries and conveniences of life, at such a pitch, as to encourage nation after nation to enter the field against us, and to take possession successively of many of our oldest and most valuable markets.

The paralysis of our factories during a strike, is the immediate cause of the erection of rival factories in other countries. The foreign market gets bare, prices rise, and draw capitalists into the empty channels. The discontented and idle workmen migrate to France, Belgium, and America, and sow the seeds of opposition. Every strike in Great Britain has been the era of new factory creations abroad. The Unions ship off their members to maintain a maximum rate of wages. During the disastrous strike in Lancashire and Lanarkshire of 1829, many of our spinners who were prevented from working, went to France, Belgium, and the United States, and introduced improved and profitable methods previously unknown in those countries; all tending to subvert our cotton supremacy.

The mill-owners naturally try to indemnify themselves for the diminution of profits arising from taxation, by a proportional increase of their business. The excess of goods thereby created leads to a corresponding fall in their price, as well as in the wages of their production. The artisans who could barely maintain their families by the ordinary hours of labour before, are now urged to extraordinary exertions so as to make up by the quantity of work for its smaller remuneration. Such circumstances derange the natural order of production, and call forth certain articles out of proportion to the real demand of the market or the wants of the consumer. All objects are not alike necessary, and several are not susceptible of any sudden increase of sale. Before the consumption of corn is reduced one-half, that of butcher's meat will be reduced to one-fourth, and that of tea and sugar to nothing.

Goods suffer an undue depreciation when they are produced during a stagnation of trade, because the manufacturers are unwilling to dismiss good workmen who could not be readily replaced at the period of its revival, and they often also continue to employ them from feelings of humanity towards their families. These circumstances, which taxation at home, and fiscal restrictions abroad, always aggravate, if they do not create, by recurring at certain periods, dislocate the universal frame of industry and commerce. To panic-struck minds the mischief often appears irretrievable. The stagnation, fortunately, seldom lasts long, because the accumulated pressure never fails to force open new outlets of trade, or to widen the pre-existing channels, with the effect of not merely restoring the equilibrium between demand and supply, but of giving a fresh impulse to production. It is surprising how small surplus of commodities is capable of inducing a great depreciation in their value. Addison remarked in the Spectator, that when the corn crops of England exceeded the average amount by only one-tenth, the price of grain fell one-half. Such a fluctuation from so trivial a cause, however, could occur only in a confined market. The wider and more numerous the channels of circulation, the more steady will be the level of international commerce.

Having shown with sufficient evidence the deleterious influence of taxes in general, few words will be required to expose the fallacy of their vindication, or rather of the panegyric pronounced upon them in a late Number of the Edinburgh Review, in a strain becoming the most venal parasite of absolutism. "On the contrary," says the Reviewer, "we believe that tax-

ation, though in a few instances it may have been injurious, has hitherto, in this country at least, operated as an incentive to industry; and that the stimulus it has given has powerfully contributed to impel us forward."*

The lash of the negro driver was in like manner an incentive to industry, a stimulus loudly lauded in its day, and declared to be the *primum mobile* of colonial prosperity. To what is the extreme depression of our agricultural interests now due, in the judgment of all candid inquirers, but to the pressure of taxes upon landlords and tenants? They regard the enormous demands of the Exchequer, which exhaust the energies of the rural classes in these rich islands, with equal abhorrence from the foresight of their consequences, and the retrospect of their origin—wars, wasteful of blood and treasure beyond all ancient or modern precedent, carried on by a system of rapine and fraud not merely against the existing race of men, but involving the interests of our latest posterity. In former times the evils of misgovernment were ere long repaired after the disturber of the world's peace was laid low; but by the chicane of modern finance, rulers may not merely sacrifice, as of old, the happiness of their contemporaries to their mad ambition, but may mortgage the well-being of innumerable generations yet unborn. Such is the deplorable legacy of debt bequeathed to Britain by her sanguinary contests with the Americans and French—people with whom, as kinsmen and neighbours, she might, under wise statesmen, have lived always in a state of peace, if not of amity. The taxes hourly levied to pay the interest of the debts contracted in the im-

* *Edinburgh Review for July*, 1835, p. 463.

molation of myriads of innocent human victims, cannot be contemplated by the philosopher or philanthropist without shame and disgust, for they are the memorials of misrule and of outraged humanity.

As capitalists have the power of shifting the burden of taxation from their own shoulders upon those of the labouring classes, in the race of competition now run by rival manufacturers, taxes may, no doubt, be admitted to act as a spur to exertion;—but upon whom does the painful part of this exertion fall? Upon the operatives, to be sure. Their comforts are successively curtailed by taxation, while those of their employers are affected slightly, if at all. The taxes levied on the provisions consumed by a landed or factory proprietor are of very secondary consideration to either of them in the amount of family expenses, but they form a considerable item in the labourer's annual outlay, and deprive him of at least one-third of the necessaries and conveniences of life. Could he obtain three pounds of bread, butcher's meat, butter, cheese, sugar, and coffee, or tea, where he gets at present only two pounds, in how superior a state of comfort would his family live! Were their employers in like manner relieved from the heavy fiscal exactions, their annual gains would be proportionately greater, they could afford to give a higher reward to labour than they actually do, without abridging their style of living, or abating the yearly savings added to their stock in trade.

The vast development of the manufacturing system of Great Britain, through the skilful application of capital to its resources of coal and iron, has fortunately counteracted, or masked in a great measure, the mischiefs of excessive taxation; had that system been

unclogged with national debt, it would certainly have enabled the people of these islands to live more comfortably than any other on the face of the globe.

From the paragraph formerly quoted the Reviewer evidently has more at heart the profits of the proprietors than the comforts of the people; whence he appears to take a very partial and erroneous view of the proper object of manufactures. "But an increase of taxation," says he, "is one of the most prominent causes of an increase of wages; and, independent of this, its direct influence on the manufacturer is precisely similar to an increase of wages. Whether he has to pay an additional sum to his workpeople, or to the tax-gatherer, is, as respects himself, not very material. In either case he will endeavour to meet the increased burden, without allowing it to diminish his capital or profits; and will thus be led to contrive and economize in a way and to a degree he would not otherwise have thought of."*

An increase of taxation being thus declared to be tantamount to an increase of wages, the master will naturally relieve himself in the only direction under his control, or which he can force to give way; namely, at the expense of his dependent workmen—for the tax-gatherer is inexorable. Economical improvements of machinery are too slow and uncertain to meet the exigency of competition with a country like the United States, which has few or no taxes to pay, and where effective wages are on that account proportionately lower. In fact, taxation affords not only a legitimate argument and ground to the manu-

* *Edinburgh Review for July*, 1835, p. 462.

facturer for reducing the wages of his workmen, but is too often used as a pretext or apology for an extent of reduction, through policy or fear, much beyond the necessities of commercial competition. As the masters have, in ordinary times, the power of accommodating the rate of wages to the general interests of their trade, they will infallibly meet the increased burden of taxation by *their* diminution, "without allowing *it* to diminish their capital or profits." Such solecisms and anti-popular dogmas as the above, are strangely out of place in a periodical so long celebrated for the soundness and liberality of its lucubrations.

Taxation acts thus as a two-edged sword against the people; it lowers the remuneration of their labour, and raises the cost of their living. The inevitable result of the manufacturers exonerating themselves by tossing off the fiscal load from their own shoulders upon those of their operatives, is a universal feeling of distrust between the employers and employed, which exists in no other country upon the face of the earth. This civil warfare between parties whose interests are one and indivisible, is entirely due to the conviction which the workmen not unjustly entertain, that their comforts are offered up as a sacrifice to the necessities of the Exchequer. Hence the destruction of those amiable charities of social life which Providence designed in ordaining the gradation of ranks; hence contempt of legislators, and violation of laws akin to anarchy, among the less favoured classes in both the agricultural and manufacturing districts of the empire.

Far be it from me to give the slightest countenance to any deeds of violence done under the pretext of

obtaining a redress of grievances. Trades' unions have on so many occasions been actuated by prejudice and passion, and have so often abused their powers by controlling the freedom of labour, as to have lost all that salutary influence which wisely-regulated friendly societies among workmen would have exercised upon the upper ranks. It is, moreover, a well-established fact, that those artisans who are the worst paid seldom combine, and never with any force; but only those who enjoy the best wages, such as cotton-spinners, engineering mechanics, founders, colliers, carpenters, tailors, &c. The daily pay of the former is indeed too scanty to allow of the formation of a heavy stock-purse to pamper a stipendiary committee of demagogues; and they are also too much dispersed and too heterogeneous to combine. Strikes have besides commonly defeated their own ends; for, instead of raising wages, and subjugating capitalists, they seldom fail to lower the one, and emancipate the other."

In the following sentence the reviewer evinces a surprising ignorance of our manufactures, and ascribes their advancement to the two most formidable evils against which they have had to contend—namely, taxation-wages and unions. "Could we suppose that from the era of the discovery of the spinning-frame and the steam-engine, down to the present day, wages had remained stationary, and strikes and combinations among the workmen been unknown, we believe we shall not be accused of exaggerating when we state that, under such circumstances, manufactures would not have made half the progress they have done."

The author of the able Memoir upon the Causes of Manufacturing Distress, crowned in May, 1832, by the

Société Industrielle of Mulhausen, says, "Taxes hinder exportation by raising the cost of fabrication; it is the tradesmen of the nation least taxed who will always carry off the business from their competitors, from which we may judge what a brilliant career awaits the commerce of the United States—that favoured land, free from public debt, and nearly free from fiscal exactions. Switzerland, our next-door neighbour, prospers from the same cause."

If we take into our estimate all the operatives employed upon cotton, non-factory as well as factory, we shall find that their wages have fallen very considerably, relatively to their work, and the comforts which it will command. Even factory wages, as in Mr. Thomas Ashton's mills at Hyde, which may be regarded as a fair type of the general mean wages in cotton-mills, have not advanced in the space of many years, during which the most remarkable improvements have taken place in the machinery and processes of manufacture.

The encroachment of foreign competition upon the cotton trade of the United Kingdom has become so rapid of late as to excite alarm for its supremacy under our heavy taxation in any mind not besotted by national pride. The continent of Europe, and the United States of America, for some time after the peace of 1814, possessed factories upon so small a scale, that they could not be regarded as our rivals in the business of the world; but now they work up nearly 750,000 bales of cotton wool, which is about three-fourths of our consumption, and have become formidable competitors to us in many markets heretofore exclusively our own.

Ever since the ministry of Colbert it has been the pride of the French government to foster the manufacturing system. A considerable manufacture of cotton cloth was commenced about eighty years ago in the Vivarais, the yarn for which was chiefly imported from the Levant, just as the cotton-wicks for the London candle-makers still are. The first spinning machine in France on the factory construction was a mule introduced thither from England in the year 1787 by Monsieur de Calonne, Minister of State. This machine, and others made in imitation of it, were set to work at Rouen, Paris, St. Quentin, Lille, Amiens, and also at Montpellier, which was the ancient seat of the household cotton trade.

Soon after this period an attempt was made to spin water-twist at Louviers. Some slight hostility was evinced towards this new system of power-spinning, but, as household cotton-spinning had not been carried on beforehand to any extent, the people were soon conciliated in favour of the new manufacture by the good wages it procured.

The following table shows the progress of the French cotton manufacture during nine years after it was fairly established:

COTTON WOOL CONSUMED.

	lbs.
1798	18,000,000
1799	10,290,000
1800	6,726,000
1801	11,008,000
1802	15,120,000
1803	15,780,000
1804	17,400,000
1805	18,412,000
1806	21,734,000

In the last of these years the cotton was manufactured into the following articles: about 1,000,000 lbs. into velvets; about 925,000 lbs. into nankeens, nankinets, crapes, and other small stuffs; about 1,155,000 lbs. into dimities, and about 14,880,000 lbs. into fustians, calicoes, coverlets, siamoises, muslins, &c. In the same year the French imported (per contraband) from England 2,000,000 pieces of nankeens, 1,000,000 pieces of cloth for printing, and about 300,000 pieces of other descriptions of cotton goods, such as muslins, cambrics, dimities, &c., valued at £300,000 sterling.

It was only in the larger spinning factories, of which, prior to the year 1827, there were few in France, that the power of water or steam was employed, and in the greatest part even of these the application of power was confined to the machinery for the preparation, or the carding and roving processes. Since then the factory system of France has received an immense development. Mulhausen and Rouen may be considered its principal head-quarters, though the districts of St. Quentin and Lille also display extraordinary activity in its prosecution. Normandy and Picardy are peopled with weavers, who carry on the business on their own account at home, and send the goods for sale to the halls at Rouen, Abbeville, &c. The finest fabrics are made round St. Quentin and Cambray. The articles made in the districts dependent on Mulhausen and Rouen are calicoes, coarse and fine, velvets, coloured goods of all descriptions, of superior beauty, from their skill in the chemistry of dyeing. At Tarare the finest book muslins are woven with yarn at one time smuggled from England, but now imported

under the new tariff of 30 per cent. on yarns above No. 140 = 165 English. Fine cotton stockings are made at Nismes, and fancy goods of many sorts, woven with silk warp and cotton weft. Lyons boasts the most tasteful articles in the cotton trade, and cotton mixed with silk, but charges a very high price for them. Madras handkerchiefs, in imitation of the Indian so called, constitute the cotton manufacture of Montpellier. The calico-printers of Alsace formerly drew their whole supplies of cloth from Paris, Rouen, and St. Quentin, but they now spin and weave goods not merely adequate to their own wants, but have a surplus for sale in the plain state.

It is in their coloured goods and sewed muslins that the French compete most successfully with the English manufacturers. They conduct their dyeing works on strictly scientific principles. The *Bulletin de la Société Industrielle de Mulhausen*, a periodical work, of which seven volumes have been published, affords a strong evidence in favour of their progress in this department of the arts; we cannot equal their madder-pinks and lilacs, nor their permanent greens.*

Power-loom goods have not been produced to any great extent in France, on account of the high price of fuel and machinery on the one hand, and of the low price of hand-labour on the other. There are not more than 5,000 looms of this description at work.

The following Table will give an idea of the progressive advance of the cotton trade in France for several years:—

* Alfred Binyon and William Nield, in Second Factory Commission Report of 1833.

COTTON WOOL IMPORTED FOR CONSUMPTION.

	1822.	1823.	1824.	1825.	1826.	1827.
Bales..	215,199	172,312	243,958	216,460	281,001	279,693

	1828.	1829.	1830.	1831.	1832.
Bales...	239,723	264,760	254,000	243,168	272,463

Table of the number of bags and bales of cotton wool imported into Havre-de-Grace in the following years:—

1831.	1832.	1833.	1834.	1835.
97,492	160,222	171,439	166,295	190,972

In 1827 reports were presented to the French government, by the several chambers of commerce and manufactories in France, concerning the causes of the distress which prevailed in that year. They stated that the protection given to their manufactures had produced an excessive stock of goods beyond the wants of the home consumption, and had caused other countries to refuse admission to the exportable surplus, though, indeed, it was that protection which had pampered them into a monopoly price beyond the level of the European market. This over-production operated disadvantageously on the French manufacturers till 1831, when the continued low prices had so augmented the home consumption, and favoured exportation of the remainder to the value of 54,000,000 francs, that the factories began again to be briskly employed, as they have been progressively since.

The cotton manufacture began at a very early period in Switzerland, for it produced, according to the annalists of that country, muslins towards the conclusion of the seventeenth century. It must have remained long dwarfish; for till Arkwright's era it attracted no notice from other nations. The first Swiss cotton-

mill was erected at St. Gall in 1798. Till the year 1817, however, nine-tenths of the yarn which they used in weaving was spun on the one-thread wheel. The weaver supplied himself usually with the yarn, and sold the cloth at the most convenient weekly market, or exchanged it with dealers for yarn. Latterly general manufacturers have sprung up, who provide yarn to the weaver, and pay him a stipulated price for weaving it into cloth, which they dispose of in various ways.

This state reminds us of the infancy of the trade in England, and while wages are high, relative to the means of subsistence, the operative may be comfortable and independent in his cottage mode of life; but when, from competition in the market, the wages become relatively low, the weaver can no longer afford to waste his time in hunting after yarn, and travelling with his small stock of goods to the market, and he sinks into penury, or a precarious dependence on petty dealers. In such circumstances the condition of the work-people at the great factories of Hyde in England, or Catrine in Scotland, is more enviable than that of the cotton peasantry of Switzerland, so extravagantly admired by some writers. The former are sustained in a steady state of comfort in good times and bad times by great capitalists, while the latter are seriously affected by every commercial vicissitude, and suffer occasionally the most painful privations.

Switzerland, being situated on the confines of European states which impose high duties on the importation of cotton fabrics, has derived great profits from the contraband trade. She has pursued the policy, therefore, of receiving goods freely, in order that her people

may get them cheap, and be able to smuggle them with advantage into the territories of her neighbours. Nor has she neglected to avail herself of the natural facilities for impelling machinery offered by her mountain streams and waterfalls. New spinning-mills have been progressively erected from year to year in the town and canton of Zurich, in the cantons of St. Gall and Appenzel, in Argovia, Thuringia, St. Blaye, near Basle, and Geneva. In some places, particularly at Zurich, water-power has been sold at so high a rate as £200 for each horse-power. Cotton wool to the amount of 56,000 bales was worked up by the Swiss manufacturers in 1832, though the cost of transmitting it from Trieste is 1d. per pound, and from Havre 1¼d. Upwards of 9,000 persons are now employed in the spinning operations, besides about 20,000 in weaving, dyeing, and calico-printing. The wages are very low; —to spinners from 8*s.* to 10*s.* a-week; to stretchers (men), 4*s.* to 6*s.*; to carders (men), 5*s.*; to drawers and slabbers (girls), 3*s.* Eighty hours are the weekly period of work in the mills. Weavers earn from 4*s.* to 4*s.* 6*d.* a-week, and 2*s.* a piece for calicoes. Mechanical looms, even with cheap water-power, could not there stand in competition against such low-priced hand-weaving.

The cotton goods resemble closely the English in their style. The fine tweels and the finer prints have successfully competed with those of Great Britain in the markets of the Mediterranean, and latterly in South America. Before the year 1822 water-twist and mule yarn, with cotton fabrics of every description, were sent from this country to Switzerland; but now all the yarns up to No. 60 are spun by the Swiss themselves;

fustians are the only article still supplied from England. The following statement of the comparative cost of spinning 40's twist was furnished by Messrs. Samue Greg and Co., of Manchester, to the factory commission.

Processes.	Manchester.	Switzerland.
	d.	d.
Preparation, &c.	·743 . .	·664
Spinning	1·855 . .	1·236
Reeling and Bundling . .	·755 . .	·513
Contingent expenses . .	1·071 . .	1·041
Interest of capital	·812 . .	1·012
	5·206	4·466

Thus the only advantage in England is the lower rate of interest upon fixed capital, arising from more work being done by the same machinery. We must add to that advantage the saving on carriage of the raw and manufactured articles. All the children in the Swiss mills are able to read and write; they attend the Sunday schools, and other religious institutions. The modern mill-work is generally preferred to weaving and printing, in consequence of the regularity and constancy of employment. The condition of the people has been improved by the mills, in taking them from agriculture, weaving, and begging. The quantity of yarn turned off per spindle is from fourteen to sixteen hanks of No. 40's per week. All the machinery used is made either in the country itself or in France. The freight from England to Switzerland is about 20*s*. per 100 pounds' weight.

Cotton manufactures are becoming objects of interest to many of the German states. Several spinning-mills have been erected in the Austrian dominions, especially in the neighbourhood of Vienna, which are driven by water-power, and produce yarn of the lower

numbers up to 60's. Their fine goods are woven with yarn smuggled in from Great Britain, though its entry is not prohibited, like the coarser, but is permitted under a high duty. To facilitate this contraband trade, small mills have been planted at Reichenberg and other spots on the Bohemian frontiers, which enable their owners to bundle up the English yarn in their own fashion, and dispose of it as such to the Austrian weavers. It is said that 100,000 weavers are employed in the neighbourhood of Vienna alone; and many at Prague, and in general throughout Bohemia, Moravia, and at Gratz, in Styria. A few factories have been erected in the Tyrol, to take advantage of the abundance of water-power, as well as the low rate of wages, and the protecting duties against foreign yarn. The goods manufactured with these yarns are of a stout quality, and well made. Nankeens are in much demand.

After many unsuccessful previous attempts, at length, in 1799, Messrs. Barnard and Brothers, aided by an English mechanic, erected at Schemnitz the first spinning-mill of Saxony. Many rival factories were soon thereafter mounted, but they all proved unprofitable from the fall in the price of English goods and their own imperfections. The Berlin decree, in 1806, which obstructed the introduction of English manufactures, revived the spinning trade of Germany, and restored it in two years to a prosperous state. After the defeat of Napoleon, in 1813, it once more gave way to the competition of England. Since the year 1818, however, the cotton-mills of Saxony have resumed considerable activity, and produce low-numbered yarns from Smyrna wool, to be woven into

thicksets, velvets, and coloured pocket-handkerchiefs. All the finer mule yarns, and nearly the whole of the water-twist, are imported from Great Britain. The yarn, whether of domestic or foreign produce, is sold to the weavers dispersed through the country villages, by whom it is woven. The cloth is sold by them at the market towns.

The imports of English cotton-twist in the excise district of Zittau, in Upper Lusatia, amounted in 1832 to 76,648 cwts. against 52,421 in the preceding year. In the other departments of excise the importation may be estimated at 30,000 cwts; so that the total import of British twist is from 10,000,000 to 14,000,000 lbs. into that small province, containing a population of only 220,000 individuals. The yarn spun round Zittau amounts to from 5,000,000 to 6,000,000 lbs. annually.

The cotton manufactures of Prussia and the Rhenish provinces are extending rapidly, not only by weaving British yarns, but by spinning also. The number of operatives now employed in spinning by power is estimated at from 6,000 to 7,000. In 1830 no less than 35,000 bales of cotton wool were worked up. With the exception of Mr. Brugelman's mill at Cromford, near Dusseldorf, where the daily hours of work are only thirteen, the factory time is fourteen hours, beginning at six, closing at nine, and allowing one hour for meals.

The average wages are—

	s.	d.	
Men	9	0	per week
Women	4	0	
Children under 14	2	5	
,, under 12	1	6	

The price of provisions is—

4*d*.	for 7 lbs. of bread;	
2½*d*. to 3*d*.	for 1 lb. of beef;	
3*s*.	for 100 lbs. of potatoes.	

There are several spinning-mills in the Grand Duchy of Baden, all of which are moved by water-power: the largest is in the Black Forest; it is called St. Blaise, and employs 600 work-people, four-fifths of whom are children. The working hours are fourteen a-day, or eighty-four a-week. No child is admitted unless *bonâ fide* twelve years of age. The weekly wages are 8*s*. 4*d*. for adults, and for children, after one year's employment, 4*s*. 3*d*. An able labourer earns in summer 5*s*. 6*d*. to 6*s*., and in winter 5*s*. The best beef never exceeds 1½*d*. per lb., and is generally lower, which, with the corresponding low price of other articles of food, enables the operatives to live quite comfortably on their wages.

The chief cotton manufacture of Prussia, which is yearly on the increase, is the weaving and dyeing of British yarns, supplied mostly through Elberfeldt. Some of the goods thus made have been sent back to England for shipment to the East Indies. The quantity of English yarn imported into Prussia in 1831 for the above manufacture was 15,600,000 lbs.

Hitherto the attempts to establish the cotton-factory system in Russia have not been very successful. But Russia consumes a very great quantity of British yarns; to the amount, in 1832, of 19,000,000 lbs., and last year of 21,478,499.

There were eleven spinning-mills two years ago in Lombardy, but they are supposed to be used chiefly as masks for the contraband trade in British cotton yarns.

About 12,000 bales of cotton wool are annually consumed in these factories. Though the wages are lower than in Switzerland, a good spinner can earn 8*s*. a-week, while a good labourer in Lombardy can earn hardly 5*s*. A great deal of British yarn is introduced into the Milanese, which is manufactured into stockings and other fabrics. The yarns of the country are woven into heavy tweels and common calicoes. All other descriptions of goods are imported at a high duty, or smuggled from Switzerland, England, and France.

There are only four spinning-mills in the Sardinian dominions, with a considerable number of hand-mules. Goods are pretty extensively woven of cotton and linen mixed. The wages are lower here than in Switzerland.—See *The Table of Exports*, Vol. I. p. 326.

We have seen, in Vol. I. Book I., that cotton wool has been long grown in the Neapolitan territories, and that a handicraft cotton manufacture has been long carried on. There are several cotton-mills in different parts of Calabria. In the new mill of Messrs. Zublin and Vonwiller, at Salerno, there are about 7,200 spindles. The machinery is good, on the newest principle, and includes the tube-roving frame. The wages are,—for spinners, 6*s*. per week; carders, 4*s*. 3*d*.; rovers, 3*s*. 2*d*.; and piecers 2*s*. 6*d*. The cotton worked up in this mill is principally grown in the adjoining fields, and costs about 6*d*. or 7*d*. a-pound. The land on which it grows is let at the very high rent of £2. 10*s*. per acre. The importation of English yarn into the kingdom of Naples may be estimated at about 2,000,000 of lbs. Weavers earn from 2*s*. to 2*s*. 6*d*. a-week. Under a liberal government, Naples,

with its waterfalls and cheap labour, might soon become an important manufacturing country.

The following remarks from a broker's price-current at Antwerp, in 1833, show the general advance of Continental competition :—

"All the accounts we receive from the manufacturing districts continue to represent the cotton factories to be proceeding under a progressive state of improvement. The results of their operations last year having opened the eyes of the proprietors to their previous error in neglecting the home market in favour of the delusive prospects held out to them by the monopoly offered to them in India, they are now applying increased attention to this branch, the beneficial consequences of which are rapidly manifesting themselves in the diminution of the imports of British goods."*

The first cotton-mill of the United States of America dates from the year 1791, when one was erected in Rhode Island. A second was erected in 1795, at the same place, after which no more was done till 1803, when a third was mounted in Massachusetts, followed there by a fourth in 1804. During the three succeeding years ten more mills were erected in Rhode Island, and one in Connecticut, making altogether fifteen mills, containing about 8,000 spindles, and producing about 300,000 lbs. of yarn a-year. By a return made to the government in 1810 it appears that 87 additional mills had been erected by the end of the year 1809, of which 62 were then in operation, 14 of them being horse-mills, and 48 water-mills, con

* Mr. Birley, in *Factory Commission Report*, Part I., Manchester, p. 117.

taining altogether 31,000 spindles. Twenty-five mills besides were expected to be placed in activity in the course of the year 1810, when the total number of spindles would be 80,000.

The capital required to carry on the manufacture in the best manner is considered to be at the rate of 100 dollars for each spindle; but in general not more than 60 dollars had been expended. The yarn spun annually for each spindle is about 36 lbs., corresponding to 45 lbs. of cotton wool, and it sells for about one dollar 12½ cents per lb. Forty persons are employed for 800 spindles, of whom 35 are women and children, and five are men; this is at the rate of one person for every 20 spindles.

A report made to the House of Representatives, in 1816, states "that the quantity of cotton wool manufactured in the year 1815 was 90,000 bales, nearly equivalent to the consumption of France at that period; that the quantity used in 1810 had been only 10,000 bales; in 1805, 1,000; and, in 1800, 500 bales. The following general statement is officially made in the same report:—

Capital engaged in 1816	40,000,000 dollars
Males employed, of 17 years and upwards	10,000
Women and female children	66,000
Boys under 17 years of age	24,000
Cotton manufacture, 90,000 bales, or . .	27,000,000 lbs.
Cotton cloth of various descriptions manufactured	81,000,000 yards
Cost	24,000,000 dollars

New tariff laws were passed, one after another, in 1824, 1828, and 1832, in each of which the duty upon cotton goods imported was declared to be 25 per cent.

ad valorem, rating the coarser fabrics as in the act of 1816.

Under such exclusive protection the cotton trade marched with an accelerated pace. Power-loom factories were established; while the most improved processes in spinning and weaving were eagerly sought after and adopted. The manufacture has accordingly expanded greatly in the New-England States, as well as in those of New York and Rhode Island, but is little known in the rest of the union.

From the reports of the Secretary to the Treasury, made to the House of Representatives on the 31st September, 1830 and 1831, it appears that the States exported the following quantities of goods :—

	1830. Dollars.	1831. Dollars.
Printed and coloured cottons, value	61,800	96,931
White ditto	964,196	947,932
Nankeens	1,093	2,397
Twist yarn and thread	24,744	17,221
All other cotton manufactures	266,350	61,832
	1,318,183	1,126,313

More than one-third of these exports were sent to Mexico, and the rest to the New States of South America, and in particular to Chili. A report of the Committee of Congress, appointed in the spring of 1832, to inquire into the progress of the spinning and manufacturing of cotton in the United States, has furnished the following statement for the year 1831 :—

In 12 States there were—

Mills	795
Spindles	1,246,503
Looms	33,506

The weight of cotton worked up was . .	77,557,316 lbs.
Deduct 2 oz. for waste per lb.	9,694,664
Total weight of yarn spun was .	67,862,652
Amount of ditto per week . . .	1,305,051
Averaging 16½ oz. per spindle.	
The number of male workers was	18,539
,, female ditto . .	38,927
Total employed in the cotton manufacture	57,466

The sum paid for wages in that year was 10,294,444 dollars, or £2,144,780.

The sum paid per week was therefore £42,895, being no less than 14*s.* 11*d.* for each of the work-people enumerated.

The capital employed was 44,914,984 dollars; the number of yards of cloth manufactured was 230,461,990, and the number of pounds of cotton was equal to what was consumed in Great Britain little more than twenty years ago.

It is difficult to reconcile the above statement of the average wages with the evidence of Mr. Kempton, a cotton manufacturer in the United States, who has been acquainted with the manner of conducting manufactories in most of them, and who employs in his own establishment 400 work-people. He says, "A person ten years old would get 3*s.* a-week, a person twelve years old 4*s.* a-week, fourteen years 5*s.*, sixteen 6*s.*, eighteen 8*s.*; those more advanced in years would earn 10*s.* The smaller children in the carding-room (between nine and twelve years) are those who earn 3*s.*; those attending the drawing-frames earn from 5*s.* to 6*s.*; those who attend the roving-frames earn 8*s.* a-week; girls attending the throstle-frames earn from

5s. to 8s.; machine-makers earn about 5s. a-day; mule-spinners earn about 5s. a-day; overlookers earn from 5s. to 6s. a-day; assistant overseers earn from 3s. to 4s. a-day.

"No. 16 water-twist, made entirely of good cotton, sells in the United States at 10½d. per pound; in England, No. 16 yarn, made from a mixture of waste twists and a small quantity of Uplands, sells at 11d. per pound."

He gives the following statement of the comparative cost of weaving in the United States and in England:

	United States.	England.
Interest on dressing machine	£2 11	£1 12
Interest on 12 power-looms	8 6	4 10
Cost per annum of one horse-power	3 10	12 10
Cost of dressing 3,756 pieces	23 9	46 18
Cost of weaving	125 4	156 10
	£163 0	£222 0

American, 10½d. per piece; English, 1s. 2¼d.

Water-power exists in America in great abundance, at a very low rent, even in the best situations; whereas in Great Britain the power is mostly steam, or, if water, it is at a very high rent." Mr. Kempton expresses his conviction that the effect of a compulsory limitation of the working-hours in Great Britain to ten instead of twelve would enable the manufacturers of the United States to undersell the British, not only in markets abroad, but in their own home markets.*

The following important Table was furnished by Mr. William Greg to the Factory Commissioners in May, 1833:—

* *Factory Commission Report*, Part I., Evidence by Central Board, pp. 23, 24.

Rates of Wages in the Cotton Factories in the different Countries of Europe, and in America.

Authority.	Country.	Quantity of raw Cotton consumed in 1831.	Hours worked per Week.	Wages per Week.						Average Wages.	Age of Admission.
				Carders.	Drawers, Rovers, &c.	Spinners	Piecers.	Reelers.	Weavers.		
——	England . .	234,000,000	69	3/0—10/0	4/6—8/0	25/0—33/0	6/0—8/0	..	9/0—12/0	7/0—12/0	9
Burns, C. G. .	America . .	77,000,000	..	..	..	..	..	..	..	14/11	..
K. Finlay . .	Ditto. . . .	..	78	..	6/8	20/0—28/0	7/0—9/0	..	9/0—12/0	10/0	..
P. Ewart . . . Burns . . . . Melly, and . . A Escher . .	France . . .	74,000,000	72—84	..	..	15/0—16/0	..	..	7/0—8/0	5/8	..
Melly	Prussia . . .	7,000,000	72—90	..	..	..	..	..	..	..	..
A Escher . . Melly, and . . Myself. . . .	Switzerland.	19,000,000	78—84	5/0	2/6—3/0	8/0—10/0	2/6	6/0	..	4/5	10
A. Escher . . Melly, and . . Myself. . . .	Austria . . . Tyrol	12,000,000	72—80	3/6—4/6	2/0—2/6	9/0—10/0	1/10—2/0	3/9	.. ..	4/0 3/9	8 8
P. Ewart . . .	Saxony . . .	5,000,000	72	4/6—5/3	2/0—3/0	6/0—7/6	1/0—1/3	3/0—3/6	..	3/6	7
Melly	St Blaise . Baden . . .	..	84	Wages are 8/6 for grown persons, and 4/3 for children . .						5/1	..
Melly	Bonn . . . Prussia . .	..	94	Men, 5/6; women, 3/0; and children, 1/6						2/6	..

A very large proportion of the cotton wool absorbed by the manufacture of America is made into domestic or other heavy fabrics, in which her advantages with respect to raw material tell with the greatest effect. Domestics comprehend a most important and extensive class of cloths used by the great mass of society for shirts, sheets, linings, and many other domestic purposes. Supposing one-half of the power-looms in Great Britain to be employed in lighter fabrics, the remaining half, or about 60,000 must be engaged in the same heavy fabrics as the American looms, which, from the above estimate, must be considerably upwards of 45,000; but, in fact, the power-looms of the United States employed upon heavy cloths cannot be much fewer than those occupied with similar goods in Great Britain. It is upon this most important class of fabrics that the tax on cotton wool, the expense of freight, and other burdens peculiar to this country, from which America is exempt, press most severely.

1. The manufacturers of the United States have the raw material of these heavy domestics much cheaper than those of Great Britain. Without insisting upon the advantages possessed by America as the grower of her own cotton for securing the tenure of her cotton trade, and the dependence of this country for her supply on foreign countries, which political contingencies may compromise or destroy, we shall merely advert here to the savings of the American manufacturer in freight and insurance. From New Orleans and Mobile to England the freight of cotton-wool is $\frac{3}{4}d.$ per pound, with 5 per cent. primage, and from the Atlantic States from $\frac{4}{8}$ to $\frac{5}{8}$ of $1d.$; from New Orleans to Boston the whole charges are no more than $\frac{5}{8}$ of a cent; hence the

savings to the manufacturer in New England in freight and insurance are no less than ½d. per pound, which upon cotton worth 7d. is equal to 7 per cent. upon its prime cost.

2. The American manufacturer saves likewise the average profits paid by the British to the class of middlemen between the sellers of cotton wool in the States and the spinners in Britain, commonly called the "cotton importers." It is through this order of merchants, who form the principal holders of the stocks of cotton wool in the Liverpool and Glasgow markets, that the spinners of the United Kingdom are supplied. A commission of 3 per cent. upon the invoice amount of the purchase is in this way paid. Besides the charge thus entering into the importer's own cost upon the cotton he is entitled to obtain a certain profit. Supposing him to carry on his business at the moderate profit of 5 per cent., this, along with the charges upon his commercial establishments abroad and at home, must be paid by the British spinner, forming permanently an extra ingredient of the cost of his material from which the American spinner is free.

3. The duty of five-sixteenths of a penny per pound, upon all cotton wool imported into the United Kingdom from foreign states, operates as a premium to the manufacturers of all other countries not similarly taxed; the difference equivalent to about 4½ per cent. upon cotton wool at 7*d*. per pound operates against the British spinner in his competition not only with the American, but with the spinners of all other countries who receive either cotton wool duty free, or get a drawback on exportation equivalent to the duty paid; even when our spinners purchase their cotton wool through

an agent in the States, and thereby save the importer's profit, the amount of charges in freight, duty, insurance, &c., varies from $11\frac{1}{2}$ to 14 per cent. more than is paid by the American manufacturer. If we add to this charge 5 per cent. for the importer's profit, paid in common cases, the sum may be estimated at fully 16 per cent.

In fine and ornamental fabrics, which contain little weight of cotton wool, and whose value is made up chiefly of the wages of labour, an extra cost of material, even to the above extent, would be comparatively of little consequence, but it is a most serious impost on the domestic cloths, in which American competition principally lies. Mr. William Graham, jun., of Glasgow, stated in his evidence to the Committee of the House of Commons on Manufactures, "that taking a piece of our staple articles in domestics, that cost us twenty shillings, I reckon that we use about twenty pounds of raw cotton; therefore that would be about twenty-two pence upon what would cost us twenty shillings."

4. The flour used in the processes of weaving and bleaching forms an item in the cost of cotton goods of much more consequence than even at first sight might be supposed; the quantity of flour used upon each piece of cloth is proportioned to the weight of cotton *which it contains, so that the extra British cost arising* from this source is greatest in those heavy fabrics in which foreign competition is most formidable, and in which the tax on cotton wool, and other causes of its enhancement, are most severely felt. Mr. Graham says that he has paid in duty on flour from £600 to £700 annually, on an average of several years.

5. The abundance of water-power, and its cheapness as compared to that of steam, are advantages of some consequence, especially in heavy fabrics. It is also one of which the most formidable rivals of the British manufacturers in these goods have availed themselves. The coarse yarns of Switzerland and Germany, which have superseded the yarns formerly sent to them from Great Britain, as also the heavy fabrics of the United States, which oppose those of Great Britain in many third markets, are all manufactured by water-power. See Mr. Kempton's statement above.

6. While combinations among the operatives of the cotton manufactures of America and the continent of Europe are unknown or ineffective, they have long existed among those of this country in a form completely organized and powerful, with the effect not only of raising the prices of labour, but also of imposing a variety of restrictions upon our manufacturers in the management of their factories, much to their inconvenience, and proportionally to the benefit of their foreign rivals.

7. The money prices of provisions have been much higher in Great Britain than in the manufacturing countries of the continent of Europe and America. Without referring here to the influence of this circumstance upon *the price of labour, and supposing, for the present,* the wages paid by the British manufacturer and his foreign rivals to be the same, still this state of things would not prove that the foreign manufacturers could derive no future advantage from the low-priced provisions of their workmen. In the event of that more serious struggle, which in the natural

progress of competition is likely to take place, the cheapness of the means of subsistence, by conferring a higher condition upon the foreign workmen, leaves more room for a reduction of wages. Mr. Kirkman Finlay, a great authority in these matters, says, "I think the difference would be this, that, if the amount of wages paid in Great Britain were absolutely necessary for the comfortable subsistence of the workmen, it would be quite clear that, whatever pressure there might be, those wages could not be permanently reduced; *but, if the money wages paid in America are sufficient to get a great deal more than the absolute necessaries and comforts of life, then, if there is a pressure upon its manufacturers, they can so reduce the wages as to meet that difficulty, and by that means undersell the manufacturers here.*"*

8. The heavy taxation, local as well as general, borne by all producers of commodities in Great Britain, must operate in favour of their rivals. High-priced provisions and labour are not the only media through which taxation increases the burdens of the British manufacturer. This cause operates still more directly by imposts upon almost every department of his business,—taxes on his postages, on his clerks, on his bills, promissory notes, and policies of insurance, on his advertisements, on the money which he borrows and pays, and on the transference of the landed property which he buys or sells. The duties on fire and sea insurances levied yearly on the cotton manufacturers of Great Britain have been estimated as follow:—

* *Report on Commerce, Manufactures, and Shipping.*

1. Annual duty of 3*s.* per £100, paid for fire insurances on £20,000,000 sterling, invested in mills, warehouses, &c.	£. 30,000
2. Duty for sea-insurances of 2*s.* 6*d.* under, and 5*s.* above 30*s.* premium per £100 (being an average of 3*s.* 9*d.*) of duty on £20,000,000 (the exports of cotton in 1835)	37,500
Total insurance taxes	£67,500

9. Since combinations among workmen, high priced provisions, and heavy taxation, keep up the price of labour, and the absence of these three evils have just the opposite effect, the cost of spinning and weaving must be perpetually enhanced in Great Britain, compared to its amount in foreign countries. The Table of Mr. Greg, page xxxiii, shows the advantage of the Swiss over the British spinner in 40's yarns, to be in the preparation processes upwards of 7 per cent., in the spinning process upwards of 50 per cent., in reeling and bundling upwards of 47 per cent., and in contingent expenses nearly 3 per cent., upon the cost of these different items as compared in the two countries;—whilst Manchester has only 24½ per cent. of advantage in interest of capital &c. upon a similar comparison; the difference in the cost of the yarn being 16½ per cent. in favour of Switzerland.

The heavy cloths, in which the competition of America has been principally felt, are woven with coarse yarns from Nos. 10 to 20. It appears from the schedule of the prices of spinning in the factories of the United States, compared with the prices paid for the same work in Glasgow annexed to Mr. Kirkman Finlay's letter to Lord Ashley in 1833, that the prices of spinning these numbers of yarn were, for a given

quantity, 4*s*. in the United States, and 4*s*. 11*d*. in Glasgow, being 22 per cent. in favour of America. The prices of carding the same numbers were in the United States 6*s*. 7½*d*. per week, and in Glasgow 7*s*. 1¼*d*. per week, being 7 per cent. in favour of America.

In the operation of dressing the warp of heavy goods, the American has an advantage of 50 per cent. in price, and in weaving of 25 per cent.; being, upon the two taken together, an advantage of 36 per cent. The total charges of dressing and weaving, are—

In England, per piece	1*s*. 2¼*d*.
In America ,, ...	10½*d*.

Or, 36 per cent. of the charges per piece in favour of the United States.

10. While the wages paid by the foreign manufacturer are *less*, the labour performed in return for them is longer continued. By the Factory Regulation Act, the British manufacturer is subjected to a variety of restrictions with respect to the number of hours during which he is entitled to work his factory, and the description of persons whom he may lawfully employ, while in all these points the manufacturers of America and of the continent of Europe are perfectly unrestrained. Of this freedom they do not fail to avail themselves. The per centage of additional time thus gained by the manufacturers of these countries, in comparison with those of England, is, on the average, in America and France, 13 per cent.; in the Tyrol, 10 per cent.; in Prussia and Switzerland, 17 per cent.: the mean of the whole being no less than 14 per cent. gained on time. A piece of domestics containing 15lbs. of yarn, and costing 22*s*., when spun and woven

in a factory working 12 hours per day; would cost only £1. 1s. 7¾d. in a factory working 13 hours; being a saving of 4¼d. per piece, constituting 7½ per cent. on the fixed charges of spinning, and 6 per cent. on the charges of weaving.

The superior skill and dexterity of British operatives have been assumed as constituting one of our chief advantages. Their experience must no doubt be more extended, in proportion as the range and variety of British fabrics are greater than those of any other country; but, in such goods as the foreigners carry into neutral markets, the superiority of the British operatives is a point by no means decided. Manufacturers of the United States, and of some parts of the Continent, claim for those employed by them at least an equality within the sphere of their own production, and to which their competition with the fabrics of Great Britain is necessarily limited. The late remarkable ingenuity of the American artisans, in their mechanical improvements, gives no countenance to the notion of their inferiority.

The impolicy of the import tax on cotton wool is so glaring as hardly to require illustration. A tax on the raw materials of such manufactures as are principally consumed within the United Kingdom, would be comparatively harmless; but since two-thirds at least of British cotton goods are exported, a tax upon their raw material operates as a bounty upon the cotton manufactures of other nations. Where duties have been imposed on importation, as in the case of sugars, wines, spirits, &c., a corresponding drawback on their exportation has been always allowed: yet cotton, as if undeserving of fiscal justice, has been ever since the

year 1798 persecuted with a series of imposts, in twelve successive rates, all tending to turn the balance in favour of our foreign rivals in that trade. No government except our own, possessing any pretensions to the title of enlightened, lays a tax upon the import of cotton wool, which is not countervailed by an equivalent drawback on exportation. The peculiar pressure of the competition in America is upon those coarse yarns, and heavy cloths, for the production of which it possesses the advantages of an indigenous raw material, unencumbered with taxation, and procured at the minimum cost of carriage. The spinning also of the continent of Europe has been hitherto directed principally to the coarse numbers of yarn which are worked up into heavy fabrics, and with the effect of depriving this country of almost all the European customers whom she not long ago supplied.

The very existence of this country depends on retaining an ascendancy in the cotton manufacture, as the principal means of enabling her to sustain the enormous burden of taxation accumulated by the war-funding system. Were Great Britain as free from taxes as the states of America or the continent of Europe, she might surrender to them a share of her cotton trade without suffering any national misfortune, but she has nothing to spare, without involving her people in distress, and her public credit in jeopardy.

In 1833, the total consumption in Great Britain of foreign and colonial cotton wool was	lbs. 293,682,976
Off, 11 per cent. for colonial	32,305,126
	261,377,850

	£.	s.	d.
Duty on above, at $\frac{5}{16}$ of a penny	340,335	15	0
Duty on colonial, at 4*d.* per cwt.	4,807	6	0
Duty on total consumption	345,143	1	0

The average loss by waste upon cotton wool in spinning being about 12½ per cent., the manufacturer drawing back duty would be a loser to that extent, unless a correspondent allowance were made upon the exported weight.

The following facts place in a strong point of view the encroachments of the American cotton manufacture upon the British in foreign neutral markets.*

The Chinese Commercial Guide, which is a collection of details respecting foreign trade in China, published by John Robert Morrison, at Canton, states that, during the year 1834, the importation from America of cotton long cloths amounted to 134,100 pieces, and of cotton domestics to 32,743; while of cotton goods the whole importation in British vessels consisted of 75,922 pieces. It further appears, from Bell's Comparative View of the Commerce of Bengal during 1833-4 and 1834-5, that during the latter year the imports of American piece goods were nearly the double of the imports of the preceding year—*viz.*, 24,745 pieces for 1834-5, from 12,800 in 1833-4.

Mr. William Gemmell, of Glasgow, who was for several years in the habit of supplying Chili with cotton domestics, has latterly been obliged to abandon the trade, after an unsuccessful competition with the

* See an able pamphlet on *The Impolicy of the Tax on Cotton Wool*, by Alexander Graham, Esq., published by the Associated Cotton Spinners at Glasgow, in 1836.

manufacturers of the United States, although he combines in his own works the operations both of spinning and weaving, so as to ship his goods at the lowest possible cost in this country, and although he has the advantage of selling them by his partners abroad.*

Mr. George Wilson, of Rio de Janeiro, writes, "We fear that we shall be under the necessity of re-shipping to Rio all the domestics that we brought down with us, as the market of Port Allegré is completely overdrawn by the Americans in this article.†

Of the Manilla market, Mr. W. P. Paton reports 35,240 pieces of 36 inches wide, and 7,000 pieces of 28 inches wide grey of American manufacture; while of British manufacture, for the same period, there were only 1,832 pieces.

Mr. Gibson, Aux Cayes, writes in 1834, "that in unbleached domestics, a class of goods of great importance, the Americans were cutting out the British."

Mr. John Heugh, of Malta, states, "that the Americans had in a great measure driven the British article (cotton domestics) from the market."

Mr. Atkinson, of Smyrna, writes, "Domestics are a very current article of consumption, but almost 20,000 pieces have lately arrived principally from America."

A mercantile house at the Cape of Good Hope, about twelve months ago, sent patterns of American domestics, as sold at certain quoted prices, to their correspondent at Glasgow, requesting that supplies might be forwarded from this country, provided they

* See his affidavit in Graham's *Impolicy of the Tax on Cotton Wool.*
† Ibid.

could be afforded at the same rates as the American goods. As it was found on inquiry that British domestics could not be shipped at these prices without a loss, the firm could not procure the supplies of goods thus requested.*

In a statistical table, which was published in a late "Lowell Mercury," that manufacturing town is said to contain nine incorporated companies, possessing a capital of 6,530,000, under whose management there are 22 mills. These mills are mounted with 100,380 spindles and 3,554 looms. They employ 4,775 females and 1,415 males, and manufacture 702,000 yards of cloth per week; consume 229,700 lbs. of cotton wool per week, and 400,000 lbs. of sheep's wool per annum; they burn annually 7,250 tons of anthracite coal and 4,100 cords of wood; use 37,950 gallons of oil, 10,500 of which are olive oil. These companies manufacture 36,500,000 yards of cotton cloth per annum, in doing which they use 11,424,400 lbs. of cotton wool or 32,604 bales, each pound of cotton making $3\frac{2}{10}$ yards of cloth. The average wages of females in all the mills, clear of board, is 2 dollars per week, and that of males, boarding themselves, is 1.25 dollar per day.

This manufacturing town, now so great, was only 10 years ago a complete wilderness—not a tree was then cut down for the purpose of building the place.

The Prussian commercial league at present includes nearly the whole of Germany. The states that have actually joined in it are Saxony, Bavaria, Wurtem burg, Baden, Hesse Cassel, Hesse Darmstadt, Nas-

* See affidavits of the above statements in Graham's *Impolicy, &c.*

sau, Frankfort on the Maine, and two or three other minor states. Holland and Belgium, Mecklenburgh, Brunswick, and Switzerland, will also be obliged eventually, for their own protection, to give in their adhesion. In short, Austria being excluded on the one side, and France on the other, it seems likely that the league will comprise, in a few years, the whole of the countries now mentioned, together with the Hanse towns. The real object of the league is the encouragement of the manufactures of Saxony and Germany, with a view to the exclusion of England altogether. If the union be not disturbed by political convulsions, the United Kingdom may be effectually shut out at no remote period, unless by repealing our corn laws, and the duties on cotton wool, we shall be enabled to cheapen labour, and undersell the manufacturers of Germany. The mean price of wheat of the first qualities at Hamburg, Amsterdam, Antwerp, and Stettin was on the 18th January, 1836, £1. 8*s*. 1*d*. per quarter, while it was in London, £2. 4*s*. 6*d*. per quarter; being 58½ per cent. higher here than in the four above-mentioned places. The mean price of wheat at New York and Philadelphia for several years back may be taken at an average of £1. 18*s*. 6*d*. per quarter, being about 38 per cent. below the British average of the ten years prior to 31st December, 1832. The extra cost of flour in Britain during these years, compared to that in the United States, will of course be in the same proportion.

In the weaving of heavy fabrics of average breadth, made of yarns from No. 16's to No. 24's, each power-loom requires about 250 lbs. of flour per annum, while in the lighter yarns from Nos. 40's to 50's,

each power-loom requires 156 lbs. Now, supposing the one-half (say 50,000) power-looms to be employed in heavy, and the other half in light fabrics, and the hand-looms estimated at only 250,000, to consume on an average eighty-three pounds each, the whole flour used annually by the British cotton looms will be 146,607 bags of 280 lbs., which at £1. 15*s*. per bag (the lowest average price of the monthly rates of the year 1834,) will amount to the sum of £256,652. If to this we add one-third more, on account of the flour used in making up the bleached goods, and take the cost of the whole above that of flour on the continent, corresponding to the comparative average prices of wheat there, during ten years prior to 1832, at 50 per cent., we shall find the British manufacturer's whole extra cost annually, in flour used in his business, above the cost of the same quantity on the continent, to be £171,041. Thus,

50,000 power looms, on heavy fabrics	.	at 250 lbs.	12,500,000
50,000 ditto on light ditto	. .	at 156 lbs.	7,800,000
250,000 hand looms, on heavy and light do.,		at 83 lbs.	20,750,000
			41,050,000

41,050,000 lbs. at 35*s*. per 280 lbs. . . .	£256,562
Add one-third for bleached goods . .	85,521
	£342,803

Fifty per cent. extra cost on that sum is, £171,041.

Observations made by the Author in a Tour through the Cotton Factories of France and Belgium, in the Autumn of 1835.

During the years 1825, 1826, and 1827, the number of cotton factories increased with such rapidity in

France, under its pampering system of home monopoly and export bounties, as to raise their supply of goods far beyond the demand, at least, relatively to the prices of production. The consequences were a rapid and unparalleled fall in their value. Credit was withdrawn by the capitalists from the manufacturers at the moment of their utmost need; many mills were shut up, and the cotton trade suffered losses which it has but lately been able to repair.

Towards the end of 1829, indeed, the equilibrium being well nigh restored between supply and consumption, manufacturers began to resume their former activity; but this gleam of prosperity was soon clouded by warlike alarms, political disorders, and the cholera, all of which, unfortunately, came in the train of the revolution of 1830. It was not till the spring of 1833 that confidence and comfort became the lot of the French cotton trade.

These crises have not, however, been unfruitful of good. They have compelled cotton-mill proprietors to improve their establishments, to spin better yarn, and at a cheaper rate; introducing everywhere most remarkable ameliorations into the whole system of the cotton industry, becoming the spirit and intelligence of a mighty people.

The yarns which have been *during the last two years exported into Switzerland, from Alsace*, in considerable quantities, have stood their ground against English yarns in all the ordinary degrees of fineness. At Tarare also the fine yarns from the Mulhausen market fetch the same prices as the English. In this case, however, the French spinner has the duty on our yarns as an additional profit over the English spinner. The

principal part of these improvements is due to the perfection of the modern machinery constructed in the workshops of Alsace, in consequence of which the spinning-frames go far more rapidly, and turn off far more work, than they formerly did. I have seen a machine in Alsace which cards, draws, and roves cotton waste, for low numbers of yarn, with an economy of labour and time truly marvellous, and unequalled, I believe, in any part of Great Britain.

This was in the factory of MM. Schlumberger and Bourcart, at Guebwiller, one of the most magnificent valleys of the Vosges, where water and steam work with gigantic rivalry.

The bobbin-and-fly frames of 200 spindles each, constructed and mounted in M. Schlumberger's factory, are, I believe, the most productive machines of the kind in existence. The spinning motion is communicated by leather straps, running upon the edges of horizontal discs fixed to the spindles, in a very ingenious manner, so as to give a smooth motion without the possibility of slipping.

The castings of iron and brass, as well as the machines made from them, seem to be as perfect at Guebwiller as in the best workshops in Manchester. The fluted drawing-rollers are peculiarly beautiful, and, as well as the spindles, fetch a higher price all over France than those imported from England.

M. Schlumberger's mules have 396 spindles, and spin everything from No. 20 up to No. 230 English. On counting the time of a stretch of both 130's and 150's E., I found them to be exactly 52 seconds each, the length being 56 inches E. Hardly any of the threads broke, affording the best proof of the good-

ness of the preparation, the excellence of the mule, and the skill of the spinner. One spinner with three piecers works a pair of mules.

This establishment contains 54,000 mule-spindles, which are employed as follows :—

27,000	for spinning from	47's to 82's E.	
24,000	,,	118 to 200 E.	
3,000	,,	35 to 47 E.	
600	for waste from	5 to 6	

In one of his mills there are 94 double cards, in another 190 single ones; 1,200 operatives are employed in them both.

Messrs. Dollfus, Mieg, and Co., at Doernock, near Mulhausen, have 500 operatives employed in their factory, in which they spin 30's F. warp=35·4's E., and 40's F., weft=47·2's E.

There are 150 cards, of which the one-half are finishers, and the other breakers; 44 of them have drums 36 inches F. in diameter; and 106 have drums 18 inches.

There are four successive drawing-frames.

The bobbin-and-fly frames have 120 spindles each. They are constructed by MM. André Kœchlin, and Co. The spindles revolve by means of a snail working in bevel wheels, with oblique teeth. Rovings vary from Nos. 10 to 20's F. (=11·8's to 23·6's E.). From 15 to 16 kilos. (31 to 35 pounds E.) are turned off in 12 hours' work, of No. 10 F.

Most of the mules have 240 spindles; a few have 360 spindles. Each pair is worked by a man and two girls. The stretch of 56 inches F. (60's E.) for No. 90's F. (106·2's E.) is performed very uniformly (by the second's watch) in 54″. A stretch of 36's E. is spun in

25″ by one spinner, and one piecer for the pair of mules.

There are 107 mules in the factory.

50 cards are arranged in one superb gallery, about 14 feet in height. The card-ends do not fall into tin-cans, as in England, but each of them is conducted down to a covered conduit on the floor, mounted with a friction-roller opposite to the centre of each card. The tender fleece descends vertically from the delivery-roller, makes a rectangular turn as it enters the square opening in the lid of the conduit, glides along the friction-pulleys in company with the 49 other ribands, all in contact, which are sustained by a horizontal travelling apron. They advance without pressure or extension, and finally turn up at the end of the gallery to be wound upon a large bobbin. Whenever one bobbin is filled, the attendant turns round the swing frame in which it plays, and thereby puts its companion empty bobbin immediately in its place. The economy of labour by this arrangement is not the sole advantage. The card-ends are much more uniform in texture than those subjected to handling and breaking in the tin-cans (*pots* F.) Nothing can be more striking than to see 50 powerful carding engines, thus pouring forth their fleecy fillets in a spontaneous, never-ceasing stream, with only one attendant to swing round their receiving reels alternately. The mechanism is called *Couloir à cardes*, that is, *card-end ducts*, consisting of an endless travelling band, running along a range of horizontal guide-pulleys.

Before giving any further details illustrative of the very advanced state of other cotton manufactories in France, I shall lay before my readers an abstract of

Dr. Bowring's evidence before the Silk Committee of 1832, on this subject, which, in flattering the pride of the English people, has served to blind them as to the risk of foreign rivalship. Dr. Bowring had derived his information avowedly at second hand, and apparently from some of the visionary non-practical cotton spinners in the neighbourhood of Paris, who plunged into a complex mechanical art while utterly unversed in its mysteries. The Doctor's abstract principles are sound, but their application seems to me erroneous, from his estimating too meanly the intellectual and physical resources of the French nation.

" While, according to the best calculation, 7,000,000 of spindles are employed in England to manufacture more than 240,000,000 lbs. of cotton, in France, according to the return of the commission which reported on the cotton trade, 3,200,000 spindles are employed to manufacture 66,000,000 lbs.; so that where the protected French manufacturer produces only 66,000,000 lbs., the unprotected English manufacturer would, with the same number of spindles, produce nearly 110,000,000 lbs.; or if the English manufacturer produced at the same rate as the French, instead of 240,000,000 lbs. he would produce only 144,000,000 lbs. In England it is estimated, according to the Parliamentary Returns, that 700,000 persons are engaged in the different branches of the cotton manufacture, and they produce nearly four times the quantity which is rendered in France by 550,000 persons, according to the returns of the French commission: that protection has thus led to the waste of more than two-thirds of the whole amount of labour employed on the protected articles. The French cotton manufacturers have had

the benefit of this prohibitory system ever since the peace, and, according to the statement made by their commission, it costs the country 47,000,000 fr. per annum beyond the sum at which the same articles might be imported from England; this is the result of eighteen years' protection, yet the testimony of the French manufacturers is that the very existence of their business is rendered doubtful from year to year." —*Report of Silk Committee*, p. 586, 22d June, 1832.

"I think that in almost all the articles of taste and fashion the French possess a superiority of between 30 and 40 per cent.; I think the English have a greater superiority than this in those manufactures, such as cotton, where mechanical aptitude is brought to bear." —P. 593. "I have had evidence enough to satisfy me, in the peculiar position in which I was placed, that at the present moment the importation of cotton-twist (by smuggling) is from 15,000,000 fr. to 20,000,000 fr. I can also speak, from my own personal knowledge, of the large clandestine importation of cotton-twist from Switzerland into France."—P. 593.

"At this moment, of the capital invested in the production of cotton-twist, I think I may state the great proportion is absolutely lost, *and the loss of the rest is inevitable*. I have had occasion to examine the operation of the system upon a very wide scale, and I state, as a general result, on the details of which I should be able to give evidence to satisfy honourable members, that this protective experiment has cost the French nation since the peace £200,000,000 sterling; and their prohibitory experiment has wholly failed in accomplishing any one object for which it was intended. Wherever there are unfavourable circum-

stances, such as are now connected with the cotton-twist trade in France, they can be no more subdued by protection than a geranium can be made to flourish in Ireland. I am satisfied that no industry can or will succeed that is not of natural growth; that all attempts to force industry have been fatal and ruinous to the nations that have made the attempt.

"If I had expected that the general state of manufactures in France would have been gone into, I would have brought some information which would show that the situation of the cotton manufacture is discouraging in the extreme; the expressions of distress which have emanated thence are stronger than have ever been heard even in this country. I have now found among my papers an address to the King, presented in the present year from Mulhausen, the seat of one of the largest manufactures in France, the first sentence of which is, 'Our looms are wholly abandoned, and our labourers without food.' The whole number of looms in the district du Nord was stated by Chaptal at 10,000: now, as evidence of the prosperity of that district, I will mention that in March last the cotton manufactory of Rouval-les-Doullens, established only four years ago by a well-known individual (who came to England and visited our most improved establishments), at a cost of 1,400,000 fr., was sold for 308,000 fr.; there was a sacrifice therefore of between 70 and 80 per cent. of the whole invested capital.*

* Similar sacrifices were made two or three years ago in England upon some considerable iron works, now in the most prosperous state.

Q. "If this trade was so distressed in March last, how do you account for an article in the *Journal du Commerce*, which says—'that our manufactures and those of Torcoing are in a satisfactory state, because the manufacturers of Roubaix, who employ them, sell their woven goods easily; within the last eight months the manufacturers of woollen yarn cannot supply the demands which are addressed to them; their profits are enormous, also the number of looms has been trebled in two months; all labourers who wish to labour, can find labour at 125 to 150 cents per day.'"—*A.* "It is impossible for me to account for the introduction of a particular article into a foreign newspaper."—P. 631. "I am intimately acquainted at this moment with the proprietor of one of the largest factories in France for the production of cotton-twist, and he assures me that he considers seven-eighths of capital invested as irretrievably lost."

Q. "With what countries were we in competition when it (our cotton trade) was rising?"—*A.* "We were in competition with France."

Q. "Do you mean during the war?"—*A.* "Yes; there was great production of cottons there."

Q. "Do they find their way into this country now?"—*A.* "Yes, wherever there is a peculiar beauty; and, notwithstanding the disadvantages under which the French labour, they bring some cotton articles of fashion into this market. Kœchlin, of Mulhausen, a large manufacturer of cottons, has, I know, been a considerable exporter for this market."

Q. "Is it not the fact, that as soon as any inventions took place in the cotton manufacture in this country, they were carried to France, and manufactories esta-

blished upon the same principle?"—*A.* "Yes, but not immediately.* In France a great change has taken place in opinion; this prohibitory system has been tried in all its bearings; its consequences are beginning to be felt; the people are gradually setting right their miscalculations, and the Government is beginning to feel its way."

In opposition to this last statement everything which I saw and heard during my recent tour in France, warrants me to say, that the people and the Government are more than ever enamoured of their prohibitive system.

How adverse the prevailing spirit in France is to freedom of trade, appears in a very striking light from the *Avant-propos* prefixed to the translation of my "Philosophy of Manufactures," lately published in Paris under the patronage of the *Ministre de l'Intérieur.*

"If we compare the exportations of France and England in the products of the four textile manufactures of cotton, wool, flax, and silk, we shall obtain an exact indication of the superiority of our neighbours, and the result cannot fail to attract the meditations of our manufacturers towards the work of Dr. Ure, in which they will see the causes of these advantages, and the means of procuring them. We have not ventured to modify the opinions of the author, notwithstanding the difference which we have remarked between his theories in political economy, and the ideas received in France. Even the painful sentiments which

* There are foreign agents in Manchester who send over to the Continent, drawings and descriptions of every new machine of any importance.

we have experienced as Frenchmen, in reading certain passages of the 'Philosophy of Manufactures,' has not prevented us from maintaining a strict neutrality. In fact, as the work was written with the best intentions, it should be published in France just as it appeared in England, in order that the whole of it may be properly judged, and that the system may be fairly unfolded before the eyes of the reader."

Among the beautiful valleys of the Vosges mountains, which bound the plain of Alsace to the west, that of St. Amarin is not the least remarkable. At its mouth is the ancient but small city of Thann, famous for its cathedral spire, of the same style and age as that of Strasbourg, as well as for its scenes of useful industry. Higher in the expanded bosom of the valley is the vast establishment of Wesserling, the most picturesque, peaceful, and well ordered manufactory which I have ever seen. It bursts upon the traveller's sight like a vision of fairy land. The pine-topped and craggy mountains that tower on either side, the sunny slopes covered with clustering vines, the river here tumbling in a cascade and there spreading into a little lake, give life and brightness to the sloping lawns of the middle space, while the huge ruins of ancient castles, hung upon the cliffs, in contrast with the elegant mansions of the proprietors, embosomed in a grove of venerable oaks below, unite to make Wesserling an object of universal admiration. Wherever we turn our eyes, the greatest activity reigns; the meadows, the corn-fields, even the factories present the most agreeable variety of pictures.

Messrs. Gros, Devillier, Roman, and Co., the rich proprietors, of whom the first and the last-named

reside with their families always on the spot, devote much of their attention to the amelioration of their work-people, to the exercise of a noble hospitality towards visiters, and to the cultivation, ornamental as well as productive, of the country. The works of Wesserling consist of cotton-mills, power and hand-weaving of calicoes and muslins, bleaching grounds, and print works.

The calico printing was commenced so far back as the year 1760.

The spinning mills, the loom-shops, the bleach-field, and cylinder press-rooms, date from the year 1802.

The establishment is placed at a distance of two leagues from all towns, and in the central point of nine villages, containing a population of from 12,000 to 14,000 souls. There is no other manufacture within a league of it.

Feelings of philanthropy presided at the origin of Wesserling. The first founders had for one of their objects to give comfortable employment to the natives of the valley; and they have been rewarded by an invincible attachment on the part of their work-people. Most of them are proprietors of a house and a little land, which their families cultivate, and the whole of them have rights to the use of the pasture-common. Their chief agriculture is that of the potato and of meadow-grounds, and they all possess cattle. They are Roman Catholics, while their masters are Protestants of the Genevese church; but both live in the mutual charities of religion.

The language of the country is still German, as of old, and the temperament of the people is a little phlegmatic, but docile; their intelligence may be

developed with a little pains, especially that of the female sex.

The proprietors founded, 16 years ago, a savings' bank for the operatives, which pays interest at 5 per cent.; and they study to persuade the youths, at their outset in life, to become depositors. Its success increases from day to day. The work-people have besides benefit societies, managed by themselves; but as the state of wages and employment seldom varies, they do not suffer from the vicissitudes of trade.

A skilful medical man is attached to the establishment, who furnishes, gratuitously, the requisite medicines and attendance to the workers and their families.

Each of the villages round about has one or two well-conducted schools; and at Wesserling itself there is an upper school, erected by the public authorities, as the model seminary of the canton. It is calculated to form the judgment and morals of its pupils.

The partners of this great firm, ten, I believe, in number, have a paternal regard to their dependents, and enjoy, as I have said, their filial affection in return; so that the workmen of Wesserling are moral and faithful to a degree rarely equalled in any body of either manufacturing or agricultural labourers.

"It is to be desired," says the benevolent M. Roman, "that a law should be passed in France, like that of England, to regulate the daily hours of labour, as well as the ages of children employed in factories, and to provide for their education." In the absence of such legislation, the heads of this establishment have instituted rules which determine a regular course of promotion in the factory, for the encouragement of zeal, dexterity, and good behaviour.

Statistics of the Spinning Mill.

Its moving power is an overshot water-wheel made on the ventilating plan, by Mr. Fairbairn of Manchester, possessing a force of 60 horses. In summer, when the supply of water becomes scanty, it is aided by two steam engines, together of 52 horses' power, constructed upon Woulfe's principle, by Aitken and Steel, with three cylinders, and working at a pressure of 3½ atmospheres. They consume only 6⅔ lbs. avoirdupois of coal for each horse power per hour, which is about one half of what is generally consumed by the Lancashire and Lanarkshire steam engines. The mill contains 24,000 mule-spindles, and has recently been placed in connexion, when necessary, with a second water-wheel, built upon the spot by an able Welsh engineer settled lower in the valley. The quantity of yarn spun annually is 528,000 lbs. avoirdupois, or about 17,600 bags, into Nos. from 30's to 45's metriques (35·4's to 53·1's English). All the yarn is manufactured into calicoes and muslins by the company.

The mules are mounted with from 180 to 240 spindles each, and are worked by young women from 16 years and upwards. No girls are admitted under 13 years of age. The number of spinsters was about 260 at the period of my visit, but they were to be increased ere now to 320, when the new mill would be finished. Each mule is worked by a young woman and a girl piecer. Every spindle produces upon an average 29½ lbs. avoirdupois of yarn in 300 days of the above counts. Louisiana cotton-wool is used for warp, and Upland Georgia for weft. The hours of labour are 14½ per day; and the wages are

1 fr. 50 c., about 1*s*. 2½*d*., to the spinner (who is however paid by weight), and 90 centimes, about 8½*d*. to the piecer. The workmen in the preparation rooms earn 1*s*. 2½*d*. a-day; grown-up girls from 9*d*. to 10*d*.; younger girls from 5*d*. to 6*d*. Mechanics, carpenters, &c., earn from 1*s*. 3*d*. to 2*s*. 10*d*. a-day, according to their power and skill.

The Weaving Department.

At Wesserling itself there are 150 power-looms, which weave very beautiful goods, not only plain and tweeled calicoes, but also striped muslins for the elegant prints, which render this establishment celebrated all over the world. There are besides 1,650 hand-looms, distributed through 70 work-shops, belonging to the firm, and dispersed among the nine villages above noticed. One hundred looms are scattered in private houses among the mountains; they weave altogether about 70,000 pieces, 33 aunes (42½ yards) long, 34½ inches E. wide; but some are broader and others narrower. The finest yarns worked up into the best muslins are procured from the manufactories of Guebwiller and Munster.

The looms and dressing machines altogether occupy about 2,000 persons, who are mostly young men and women 16 years of age and upwards. The daily wages are as follows:—

Winders, 60 to 110 centimes,	from 5½*d*. to 10½*d*.
Warpers, 1fr. to 1fr. 50c.	,, 9½*d*. to 1*s*. 2½*d*.
Dressers, 2fr. to 2·75c.	, 1*s*. 7*d*. to 2*s*. 2½*d*.
Hand-loom weavers, 80c. to 120c.	, 7½*d*. to 11½*d*.
Power-loom weavers, 1fr. to 1·75fr.	, 9½*d*. to 1*s*. 5*d*.
Muslin hand-loom weavers. 1fr. to 1·50fr.	, 9½*d*. to 1*s*. 2½*d*.

Total 1,748 workpeople employed in the weaving factory department.

The details of the bleach-works and print-works do

not belong to the present volumes. I shall content myself with stating the total number of operatives:—

In Spinning	320	
Weaving	1,748	besides those who work in their own houses.
Bleaching	38	
Calico printing	1,070	
Total operatives	3,176	

I can assure my readers that entire confidence may be reposed in the preceding statistics, most liberally communicated to me by M Roman himself. The mechanical power employed at Wesserling is as follows:—

One hydraulic wheel for spinning . . .	60	horses' power.
One ,, for power-weaving, &c.	34	,,
One ,, for washing, pumping, &c.	20	,,
One ,, for the Calender, &c .	10	,,
One turbine (new horizontal water-wheel) for calico-printing machine	7	,,
One hydraulic wheel, turning shop . . .	2	,,
One ,, at St. Amarin, power weaving	30	,,
One ,, bleaching	15	,,
Two steam-engines, for spinning. . . .	40	,,
One ,, and dressing warp	40	,,
One ,, madder dyeing	12	,,
One ,, power-weaving	30	,,
Total horses' power	300	

The power-looms worked very steadily at the rate of 96 to 100 pecks a-minute; and as they go 14½ hours a-day, instead of 11½, as in England, they will turn off more than an English power-loom, making 120 pecks a-minute. For 11½ : 14½ :: 100 : 126. Thus the English loom would need to make 126 pecks a-minute to do the daily work of a loom at Wesserling. One young woman tends two looms, as in our factories.

In the several power-weaving establishments which I visited in France and Belgium, I always found that potato-starch was greatly preferred to the best flour for making the dressing paste. The following recipe was obligingly given me by M. Philip Gros at Wesserling.

In 275 lbs., or 27½ gallons of water, heated to 154° Fahrenheit, in a copper, dissolve one pound nine ounces of blue vitriol (sulphate of copper), mix thoroughly 33 lbs. of potato-starch with 5½ gallons of water at 90° Fahr. in a pail, and pour this mixture into the copper-boiler (not iron), and let the whole boil for half an hour, stirring all the time with a wooden ruler. The sulphate of copper prevents moulding and fermentation. It should be employed fresh, and made from day to day. The semiputrid paste used in some of the Scotch and English loom-sheds is an abomination. The most skilful manufacturers on the Continent have carefully proved the decided superiority of potato-starch over flour-paste for their power-looms. They consider it cheaper and better. A pound of it may be made in Lancashire for twopence, and it will go much further than a pound of flour.

In the year 1834 there were 540,000 mule-spindles at work in the department of the Haut-Rhin (Alsace), which consumed annually about 15,600,000 lbs. E. of cotton-wool; being nearly 52,000 bales of cotton chiefly American and Egyptian; and produced 13,200,000 lbs. of yarn of many different numbers.

The raw material may be valued at	18,000,000fr.
The yarns at	35,000,000
Difference	17,000,000

Of the cost of manufacture, one-half may be reckoned wages of labour, and the other half general factory expenses. The number of operatives of both sexes employed in the mills of that department is about 18,000, old and young.

M. Nicolas Kœchlin, one of the Deputés of the Haut-Rhin, a cotton manufacturer, and President of the Chamber of Commerce of Mulhausen, in his examination before the Enquête Commerciale of the French ministry in 1834, as well as in his *Replique*, to certain observations made upon that evidence, published in 1835, gives the following statement of the cotton trade of the world.

"The manufacture of cotton-wool amounts, in—

	Kilogrammes.*
Great Britain, to	150,000,000
France	40,000,000
United States	18,000,000
China, being one-half the crop of India .	15,000,000
Switzerland, Saxony, Prussia, and Belgium	17,000,000
Total	240,000,000

"The consumption of cotton in France is nearly one-fourth of that of the United Kingdom, and as we spin in France, for reasons to be afterwards specified, a little more per spindle than they do in England, we must have about 3,500,000 spindles, producing annually 34,000,000 kilogrammes of yarns of every sort; 105,000,000fr. (£4,200,000 sterling, nearly) may represent the reduced actual value of the machines and the factories, calculated at the rate of 30 francs per spindle. Formerly well-mounted mills,

* One thousand kilogrammes is very nearly one ton English; and 50 kilogrammes, therefore, very nearly 112lbs.

like those of Alsace, cost from 50 to 55 francs per spindle, whilst at present they may be erected, with the most improved machinery, at the average price of from 40 to 43 francs per mule spindle.

"In regard to the quality of our yarns, I think that for the numbers which constitute nine-tenths of the consumption, we have nothing to envy in the English. Alsace exported, during the late commercial crisis, a considerable quantity of yarns to Switzerland, and it was able to stand well in the market against those from England. Several of our leading mill-owners paid a visit to the English factories in the course of last summer (1833), and they have assured me that they saw nothing particularly interesting, and that except in the higher numbers, Alsace was not a whit behind hand. It is, besides, of little consequence to France to spin the finest numbers, as there are but a few establishments for the purpose in England, and they produce enough for the wants of the whole world. Most of these fine-spinning mills have existed for many years; their sunk capital is long since realized, and hence they could easily destroy the competition of any new factory.

"Our 3,500,000 spindles produce annually, as I have said, 34,000,000 kilogrammes of yarn, worth upon an average . . . . 170,000,000 fr.

"And consume 37,000,000 kilogrammes of cotton-wool, worth .	88,000,000
"Leaving for the cost of labour, fuel, repairs, interest of money and profits	82,000,000

"The number of work-people employed in our cotton-mills may be estimated at from 80,000 to 90,000.

Their average daily wages are 1fr. 30c. (1*s.* 2½*d.*) per individual.

"In comparing our cotton industry with the English, I may observe that during the war, and for want of intercourse with our neighbours, the construction of our machines was infinitely inferior to theirs. I was personally struck with this difference, when I made a tour in England in 1810, by means of a foreign passport; I was the better qualified to judge, as our own firm then undertook to fit up factories for spinning, and furnished in fact the first machinery to M. Nicolas Schlumberger. But at the present day, in his establishment, as in the others of Alsace, traces of the old machines are hardly to be found. Many proprietors have renewed them three several times. MM. Schlumberger, and Co., have erected their mill for spinning the fine numbers in a style of perfection which has many a time astonished even the English spinners.

"In England, in consequence of the competition among the numerous machine-makers, and the low price of the iron and coal, the machines are much cheaper than in France. A mule costs in Alsace ten francs per spindle,—in England it may be had for six; but luckily for us the greater expense of building among our neighbours makes a compensation of about 25 per cent. in our favour on the edifice itself. Upon the whole, the cost of erection may be reckoned one-third less in England than in France, a disadvantage which our government should study to compensate by a reduction of duty on the importation of machines, by improving the means of internal intercourse, and especially by facilitating the transport of

coals. Most of the mills in Alsace are moved by water-power; those which depend upon steam-power place from four to five per cent. of the price of their yarns to that account. At Manchester the fuel forms not more than one per cent. of the cost of spinning.

"Yet the English do not economize their fuel as we do. They employ five kilogrammes of coal (11lbs.) per kilogramme of yarn, of Nos. 30 to 40, whilst we consume not more than four kilogrammes for the same weight of yarn."

"From a calculation taken from one of the most considerable cotton-mills in Manchester, it appears that a spinner conducting two mules containing together 620 spindles, produces no more than 125 kilogrammes of yarn in the week (280lbs. English) Nos. 36 to 38 English, or one kilogramme for five spindles per week. Our spinners in Alsace are at least equally productive. It must be remarked, indeed, that the hours of labour in the English mills are limited by law to 12 hours per diem, whilst they extend pretty generally in Alsace to from 13 to 14 hours, without reckoning the meal-times."

"The following are the mean weekly wages at Mulhausen, Manchester, and Zurich; there are mills, however, in the valleys of the Vosges, where the wages are one-third lower than at Mulhausen.

"Nicolas Kœchlin and brothers pay—the spinner 14fr., the piecer 5fr., the card-tenter 6fr., the labourer 9fr.

"Mr. H. at Manchester, pays—his spinners 38fr. each on an average, the piecers 10fr., the card-tenters 12fr., the labourers 20fr.

"Mr. E. at Zurich, pays—the spinners 12fr., the piecers 3fr., the card-tenters 5fr., the labourers 8fr.

"These three establishments spin chiefly from Nos. 30 to 35$^{m}/_{m}$ (35·4's to 41·2's English).

"At Mulhausen the expense of spinning one half a kilogramme of the said yarns, is as follows:—wages 31 centimes; power, heating, and lighting, 11c.; interest of sunk capital and sinking fund (from 10 to 15 per cent.) 17c.; general expenses, repairs, &c., 13c. Total 72c.

"At Manchester—wages 52c.; power, &c., 3c.; interest, &c., 11c.; general expenses, &c., 10c. Total 76c.

"At Zurich—wages, 10c.; water-power, 0; interest &c., 15c.; general expenses, &c., 15c. Total 60c.

"The following is a statement of the cost of spinning half a kilogramme of weft from Nos. 42 to 47·2 English.

"Wages 17c.; interest, &c., 11c.; general expenses, &c., 19c. Total 47c.

"One of the principal spinners of Alsace gave me the following statement for last year.

"A mule of 396 spindles produced daily 18 kilogrammes of No. 30$^{m}/_{m}$ warp, (No. 35·4's English), which at the then current price of 5fr. 20c. per kilogramme, amounted in value to 93fr. 60c.

"In spinning these 18 kilogrammes, 20 kilogrammes of Louisiana cotton wool were consumed at the price of 2fr. 60c. per kilogramme . . . 52fr.

"Cost of spinning per mule (everything included) . . . . 20fr.

Total 72fr.

Hence the daily profit on this mule of 396 spindles was . . . . . . 21fr. 60c.

This spinner reckoned no more than 56c. for the cost of spinning his half-kilogramme of yarn.

"It results from these calculations," says M. N. Kœchlin, "that Switzerland has a slight advantage over us, especially wherever our mills are driven by steam-power; that France, everything being taken into account, has an advantage over England; an advantage which will increase in proportion as the duties on the raw materials, and on the iron shall be reduced, and that the privileges of the ports which give the English at present an advantage in the purchase of cotton wool, shall be suffered to pass away with the prohibitive system. Our house at Loerrack in the grand duchy of Baden, received a few weeks since some yarns from England, which came to very nearly the same price as the Swiss.

The import duty on the cotton wool in France increases the cost of the yarns from Nos. 30 to 40$^{m}/_{m}$ (35·4's to 47·2's English) by about 5 per cent., and that of the coarser yarns by about 10 per cent. The actual duty on the cotton wool of the United States is 20fr. per 100 kilogrammes, or about 8*s*. 2*d*. per 110 lbs. English; nearly 9*d*. upon 10 pounds, that is, nine-tenths of a penny per pound,—but there is a fully equivalent drawback on the exportation of the manufactured cottons.

"In regard to the weaving department, if we assume for a basis the manufactures of Alsace, it would follow that the 34,000,000 kilogrammes of French yarns, would require, to convert them into cloth, 270,000 looms, employing 325,000 operatives, at the average

daily wages for each, of 75 centimes (7*d.* English). The following is a statement which I received the other day from Switzerland, where weaving has always kept its ground against English competition. This statement is calculated for a cut of 50 *aunes,* which is afterwards divided into two pieces, three-quarters wide, and 75 *portees* (porters).

Cotton yarn, at the market price . .	29fr.	55c.
Cost of weaving	7	20
Warping and dressing	0	60
Repairs and interest	0	75
	39	18

The *aune* (ell) therefore costs in Switzerland 78 centimes, of a quality equal to what is now sold in Alsace at 90c.; including the extraordinary profit at present on yarns. Thus between the *cost* price in Switzerland, and the *sale* price in Alsace, just now when business is very brisk, there is a difference of only 15 per cent. It appears that the cost of manufacturing calicoes in Alsace is 22c. the ell, in Manchester (power-loom cloth) 24c., and in Switzerland 19c.

" The bulk of the Alsace fabrics is a calico intended for printing, which is exported to the Swiss printers only in certain cases; *viz.,* when the yarns are cheaper in Alsace than in Switzerland, from an occasional glut in our markets. The qualities for printing which suit the consumption of France, suit neither the English nor the foreign markets in general; so that the French surplus can find no other good vent. This circumstance, however, will, on the other hand, prevent the surplus stocks of England, manufactured for different

markets than those of France, from inundating our country." The subject of printed calicoes, extensively considered by M. Kœchlin, does not fall within the scope of the present publication.

Great misapprehensions prevail concerning the physical and moral condition of the factory operatives abroad, especially in the fertile region of Alsace. They have been represented as being mostly Protestants, and in very comfortable circumstances.* There can be no greater mistake. Indeed the most remarkable proof which can be adduced how greatly Protestantism is propitious to enlightened industry, is the fact, that among the great multitude of factory proprietors in Alsace there is but one Catholic, though the country is covered with popish shrines, and the working classes are devotees of the Romish communion.

The *Société Industrielle* of Mulhausen, distinguished for the science and patriotism of its members, when recently called upon by the Minister of Instruction, to give him an account of the state of the operatives of that district wrote as follows:—"They are allowed a quarter of an hour for breakfast, and an hour for dinner: working for the most part from five in the morning till eight at night. Each family sleeps generally together in one room, which is a cellar or a garret of the smallest possible dimensions. Their furniture is wretched, often only "un grabat pitoyable pour toute la famille." They are very ill-clothed, often need the aid of the *Société de bienfaisance;*

* The French (in Alsace) "appeared a very comfortable set of people." See Edwin Rose's Evidence before the Factory Commission, First Report, D. 1, 121 and, Mr. Cowell's comments upon it in the Supplementary Report, p. 119.

and are very dirty, especially those in the spinning mills. "Dans les ateliers on entend souvent les propos les plus scandaleux, que les enfants saisissent avec avidité, et repètent avec une satisfaction révoltante. Beaucoup des ouvriers vivent en concubinage. Ils appellent ces sortes d'unions mariages à la Parisienne, et en ont fait un verbe allemand, *parisiren*."

"If Sunday be a day of rest and tranquil pleasure to those who work in a moderate manner through the week, it is, on the contrary, a day of debauchery and orgies to those who, having been kept at labour beyond all reasonable bounds, take that occasion to riot in their liberty. Hence it is not uncommon here to see drunkards of from 12 to 15 years of age. Their degree of instruction is very slender. All their physical, and in consequence all their intellectual faculties, are exhausted with toil. This grievous evil can be removed only by a law like that enforced in England during the last two years. Certain enlightened proprietors have established at their own expense schools within their mills, at Mulhausen, and especially M. Nægely.

"The cruel conduct of parents in sending their children at an almost infantine age to the factory, seldom fails to entail fearful retribution; for whenever the children begin to discover the mercenary bargain of which they have been made the victims, they take the first opportunity of renouncing the filial engagement, and of abandoning their parents. And this alienation (*désaffection*) in the family, aggravated often by the brutality and ignorance of its head, is one of the main causes of the misery which prevails among multitudes of the workpeople."

"The operative spinners of Mulhausen are generally pale, and subject to chronic catarrhs which degenerate often into phthisis. The piecers and card-tenters sometimes lose the first joints of their fingers. The weavers are often seized with chronic rheumatism."

It is to be hoped that the French Ministry and Legislature will no longer lend a deaf ear to these powerful appeals of their most enlightened manufacturers in favour of humanity; nor allow the world to suppose, that like their late master Napoleon, they are willing to sacrifice the well-being of their people to international pride and rivalry,—a patriotism meanly spurious.

Cour de Lorraine, in Mulhausen—Factory of Jean Kœchlin and Co.

No. 32's. Fr. = 38's. English; warp, a stretch of five feet English in 28″. 300 spindles in each mule, two pairs being worked by one spinner, one piecer, and one creeler or scavenger: three halfpence are paid for spinning one pound of cotton into such yarn: 20 lbs. of yarn are turned off daily by each mule. But of No. 28's. Fr. = 33's. E. from 22 to 23lbs. are turned off in the day.

Each floor is 120 feet long, 40 wide, and 11 high, and contains 12 mules. There are three floors in that mill.

40 cards, 22 fine and 18 coarse.

3 bobbin-and-fly frames, containing 88 spindles each.
5 do. . . . . 50 do.
3 do. . . . . 42 do.
3 drawing frames of 8 heads each.

Time of work from five in the morning till eight at night; out of which 15 hours 1½ hours are allowed for meals, leaving for employment 13½.

The workman who superintends the batting and spreading-machine is paid 50 *sous* a-day. Piecers earn from 10 to 12 francs in 15 days, or from four to five shillings a-week. Creelers, or scavengers, from 5 to 6 francs in 15 days.

Card-tenters, 20 sous a-day.

Bobbin-and-fly tenters, 30 sous a-day.

Manager of the factory, 100 Louis per annum.

The factory of M. Nægely at Mulhausen is a modern structure in comparison with that in the Cour de Lorraine. It forms a great quadrangle of masonry, with a spacious court in the middle. There are 80,000 spindles mounted in mules, bearing from 300 to 396 each, one-half of them being of the latter number. I counted three stretches in 76″, each 56 inches long, of warps, No. 35's English counts. His new mules were to go still quicker, though this is very good work. Breakages very few. There is, in fact, no handsomer or better going factory for these numbers of yarn than M. Nægely's at Mulhausen. A pair of mules of 396 spindles is worked by one spinner, two piecers, and one creeler or scavenger. The spinner receives two francs upon an average for 13¾ hours work; the piecer one franc, and the creeler (*bobineur*) eight sous, (something less than eight halfpence). Only 800 operatives were employed at that time in the mill; but a great many more would be engaged, when the new part, just built, was filled with machinery. Thirty hundred weight of cotton yarn was then spun daily with his existing 37,000 spindles; and seven hundred-

weight of cotton-wool was put through each breaker finisher-card in a day of 13¾ hours.

The cost of bringing the cotton-wool from Havre over-land to Mulhausen, and all the district round, is 5½ sous per lb., which includes also the duty on importation.

Of the order maintained in the cotton manufactories of Mulhausen, the following *Public Regulations* of Mr. Charles Nægely's mill afford evidence:

Article 1. Every operative who enters the establishment may quit it within 15 days, and his master has in that time the power of dismissal; after which he and the operative must each on his part give a month's notice. This notice of discharge or quitting must be given in the counting-house on the pay-Saturday, before the time of receiving pay; it will be inscribed in a register with the date; those operatives, however, who are dismissed by the master for ill behaviour or mismanagement lose that benefit, and may be discharged upon the instant.

2. The hours of employment will be stated in a printed bill. If any derangement of the steam-engine, or the preparation machines, or any other circumstance, should call for night-work, each operative is bound to give it; provided it do not exceed one night in the week without his consent.

3. The ringing of the bell will announce the entrance of the workpeople; a quarter of an hour after it ceases, the janitor will shut the gate and make a report to the counting-house of those who are too late. The sick are required to give previous intimation, in order to avoid a fine. The bell-ringing will in like manner announce when the operatives are to quit the mill.

4. Every operative who comes too late, or who stays at home without leave, will be fined in double the value of his absent time; the minimum of this fine will be one-third of a day's wages.

5. There is no suspension of employment but on the Sundays and legitimate festivals; absence on every other occasion will be considered as misconduct, and punished according to the preceding article; an appeal being always open, however, to the *Concile des Prud' hommes.*

6. No operative can quit the mill during the working hours, unless he shows the janitor a permission to do so; and if the janitor neglects his duty in this respect he will pay a fine of 50 centimes, and the operative will be punished for misconduct.

7. If an operative is enquired for, the janitor will call him, and make the visiter wait at the door. It is strictly prohibited to admit, without permission, any one not employed in the mill; and operatives who shall introduce any person, under any pretext whatever, will incur a fine of fifteen days' work.

8. The overlooker, or the workman charged with repairs, each in his own department, is alone empowered to remedy what is wrong; they will be called upon for this purpose by the operative; but he himself must not pretend to make the slightest repair, under the penalty of a fine of two days' work, and the damages which may proceed from his interference.

9. All the operatives, without exception, employed in the workshops of the mill are personally responsible for the preservation of the tools and other objects entrusted to them; such of these objects as cannot be found when wanted will be replaced at their expense.

10. No operative is to remain in the mill during meal-time; he must enter only into the apartment assigned him, and if by any accident the moving power is stopped, the operatives are strictly forbidden to run into the other rooms; they must, on the contrary, remain close by their machines. Every disobedience of this order will be punished with a fine of half a day's work.

11. A bell will be rung daily, at an appointed hour, to warn the operatives to clean their spinning machines, which they must attend to under a penalty of 25 centimes; and after every general cleaning, which will take place once a week, an inspection will be made, and those operatives who have ill cleaned their machines, will be fined in one day's work, or more according to circumstances.

12. Every operative who gives in bad work will be fined in proportion to its defects; as also every one who returns his waste stuff ill sorted. The breakages committed in the workshops will be paid for by all the workmen of that shop, unless they point out the individual in fault. This order comprehends also the passages, staircases, and dining-room.

13. The rate of wages, and the remuneration paid to operatives working by the piece, as well as the minimum of the amount of work to be done, are to be settled according to circumstances, and will be intimated in bills. Each operative is held bound to conform to them, as well as to the regulations hung up in each room.

14. It is strictly forbidden to smoke within the precincts of the factory, under a penalty of a day's work.

15. The operatives who come to work in a state of drunkenness, or who disturb the peace, will pay a fine equal in value to two days' work, besides the correctional punishment authorized by the laws.

16. It is forbidden to make or deposit any nuisance in the court-yard. The *lieux d'aisance* must be kept clean; and whoever defiles them will pay 50 centimes to the porter in charge of them.

17. The janitor is ordered to inspect every operative on going out of the mill; every person must conform to this measure, often indispensable, as well for the interests of the proprietors, as of honest work-people themselves.

18. To prevent the risk of fire, no workman is allowed to extinguish his lamp without an order. The lanterns of the workpeople will be in general furnished with a candle, and kindled by the porter, under the penalty of a day's labour.

19. It is strictly forbidden to enter, or leave the mill, unless by the door leading to the high-way, or to go out by the windows of the ground-floor under a penalty of six francs.

20. Spinners cannot change their piecers or creelers without the consent of the overlooker, under the penalty of half a day's labour.

21. The operative who will make known at the counting-house a breach of trust committed by another operative, will be recompensed, and his name will be concealed.

22. Every act of disobedience on the part of the workpeople against their master, or against the persons invested with his authority, will be punished according to circumstances, with from one day's to five days'

labour; and the violator will be held responsible for whatever mischief may occur.

23. The operative detected in throwing cotton or waste into the water-closets, or any other place, will be fined in five days' work.

24. The workpeople are forbidden to touch the heating or lighting apparatus, the water-stop-cocks, and conduits in the apartments, as well as the moving power, under the penalty of a day's work, and paying for the damage they may occasion.

25. In return for the protection and paternal cares which all employed in the establishment may expect from their *chief*, they promise him attachment and fidelity as well as the disclosure of everything contrary to order, or to his interest, which may come to their knowledge.

26. The present Regulations will be suspended in all the apartments, and if any one of them be defaced or torn, the persons in that apartment will pay a fine of five francs, should not the person in fault be pointed out.

The above *Règlement de Police,* is printed in two columns; the one French, the other German.

I passed some agreeable days at Rouen, visiting under the hospitable auspices of M. Barbet, *Maire* and *Député,* the objects most interesting among its cotton manufactures, but I need not occupy my reader's time with the details, which would be nearly a repetition of what has been already laid before them. Should any one entertain doubts concerning the excellence of the engineering and machine-factories of France, he may have them very readily dissipated by calling, on Messrs. Barker, Rowdcliffe, Sudds, and

Atkins, at Rouen, who can show him as perfect tools as any which exist in England. They will see one of Fox's best planing-machines, value £900, Sharp and Robert's key-groove cutting-tool, and many others of equal beauty and productive power. These gentlemen prefer the coal of Mons to that of Newcastle at the same price; the former being more dense and durable in the furnace.

The cotton manufacture round Lille, and in the whole of the department of the North of France is also in a state of signal prosperity.*

Political events have within these few years operated very injuriously against the cotton industry of Belgium; hemmed in by prohibitive France on the one side, by hostile Holland on the other; exposed to the Prussian League on the northern land frontier, and the formidable competition of Great Britain by sea. The cotton-spinners of Ghent merit more sympathy than they seem to receive from the actual government, which dislikes them on account of their very natural attachment to their late king, who aided them with capital, and laid open to their enterprizes the richest islands of the Indian Archipelago. Belgium enjoys, however, excellent facilities for manufacturing cottons, in the cheapness of her fuel, iron, and labour, as well as in her central situation, her admirable means of internal transport by roads and canals, and her commodious harbours of Antwerp and Ostend.

Some of the factories which I visited at Ghent are most creditable to their proprietors. I know of no power-loom-shed in Great Britain so magnificent, so

* No fewer than 60 new cotton-mills were in course of erection last year in France.

well lighted, and so well aired, as that of M. Claes-Decocq, in that city. Here 600 looms are distributed in two lofty glass galleries, each 275 feet long and 50 feet wide, more like a royal conservatory of plants, than a weaving factory. The looms are of the best construction, they make 110 shots in the minute, and as they work 14 hours a-day, except on Mondays, when they work only 9½ hours, it is easy to see that in productive power they surpass most of the power-looms of England.

The dressing-machines, 32 in number, turn off each per week from 40 to 50 cuts, of 100 Flanders *aunes*, equal to 76½ yards English. The dressers receive in wages 20 French francs (16*s.*) weekly for the above stated hours of employment. The whole of these machines are moved by a steam-engine of 40 horses' power, on the system of Woulfe, working at a pressure of 3½ atmospheres, and consuming hourly, about seven pounds of coals per horse power. The establishment, including the purchase of ground, cost altogether 800,000fr. or £32,000, very nearly.

M. Claes-Decocq has a spinning-mill at a small distance from his weaving factory, where I was not a little surprised to see mules making four stretches of number 32 yarns regularly every minute. Each mule carries 240 spindles, and is worked by one spinner, one piecer, and one creeler; the wages of the three is 18 francs (somewhat less than 15*s.*) a-week; of which 10½*d.* English, are daily paid by the spinner to his two assistants, leaving about 9*s.* 6*d.* a-week to himself. One spinner was pointed out to me who had turned off 115 kilogrammes (241lbs. avoird.) of yarn No. 30 in the course of the preceding week; but he worked 14

hours instead of the average 13½, and was reckoned a superior hand. The waste was only eight per cent. in Upland Georgia cotton-wool, indicating very careful and cleanly manipulation in the whole process.

There are excellent machine factories in Ghent, one of which, belonging to Mr. Bell, an English mechanical engineer, has lately produced an improved bobbin-and-fly frame which turns off 350 kilogrammes of rovings (770lbs. English), being about 26 per cent. more than had been previously produced.

I visited several other cotton factories in that city, and observed them to be all actuated by a zealous spirit of emulation, against their French and English competitors. They complain, and probably not without reason, that from the moderate import duties into Belgium, the refuse articles of the English and French trade of the preceding season, are not unfrequently poured into the Brussels market at very low prices, and from the caprice of public taste preferred to the home-made articles of more recent date. It is well known that many of our great manufacturers can afford to make a sacrifice upon the remainder of their printed goods at the end of the season, in consequence of the profits which they have realized at its commencement.

The cotton manufacture of Belgium receives its raw material nearly free from import duty; for it pays only 4½*d.* on 112lbs., whereas that of the United Kingdom pays 70*d.* The mean price of wheat in Brussels, per English quarter, is about 34*s.* Good beef costs at Ghent 4*d.* per pound English; refined sugar 7*d.*, coffee 4*d.*, tobacco 9½*d.*

The following comparative table of wages is given by the merchants of Brussels in their *Mémoire sur la*

Fabrication et le Commerce des Tissus de Coton en Belgique. Dec. 1834.

Daily wages in	Ghent,		Mulhausen,		Rouen,		Manchester.	
Spinners .	f. 2·50 to	3·00	2·00 to	3·00	2·50 to	3·50	6·25	
Weavers .	1·25	1·50	1·25	2·00	1·50	1·75	2·90	
Printers of calico	1·25	2·00	1·25	3·50	3·00	6·00	5·00	
Labourers	1·00	1·50	1·25	1·50	1·50	2·00	2·00 to	3·00
Women ..	0·75	1·00	1·25	2·00	1·25	1·50	1·60	3·00
Children .	0·35	0·75	0·25	0·75	0·6	1·00	0·50	1·50

The import duty on 100 kilogrammes of white cotton goods into Belgium is 60 florins (108fr. 84c. French, about 21*s*. 9*d*. per cwt. English); and 80 florins (145fr. 12c. French) on importing 100 kilogrammes of printed calicoes. Upon the heavy white goods for common wear, the actual duty amounts in some cases to from 30 to 50 per cent. *ad valorem.* This law is favourable only to the importation of the finer and lighter qualities of cotton goods. Cotton yarns, Nos. 30 to 40, are, according to the writers of the above memoir, somewhat cheaper in Belgium than in Manchester, and considerably cheaper than the protected yarns of Mulhausen and Rouen. The same holds true of the cloths woven with these yarns.

Concluding Remarks.

One of my principal aims in writing this treatise, and the Philosophy of Manufactures, has been to make our legislators and other influential citizens, familiar with those factory arrangements, operations, and machines, which constitute the main sinews of our national strength, so that they might learn to enact such wise and equal laws as would at once maintain the revenues of the state, and ease the burdens of the people. An

experience of many years in teaching the principles of the mechanical and chemical arts to pupils of every grade of education, has, I trust, enabled me to present the objects of research in as intelligible a manner as their complexity would permit. In the present, as in my preceding work, I have used the utmost diligence to collect the best information upon every subject, and have had the good fortune to procure the assistance of several skilful manufacturers, and mechanicians, in surmounting various difficulties which I encountered in the explanation of the diversified and intricate series of operations of our cotton manufactures.

The chef d'œuvres of mechanism, like those of music, poetry, and painting, can be ill appreciated by persons unacquainted with their respective principles, or who have not qualified themselves by special study to compare their results with the difficulties conquered, and to trace out the scientific resources put in requisition. The ordinary education and amusements of life, indeed, may in some measure cultivate a taste for the fine arts, and may lead individuals to contemplate with real or pretended pleasure even their more homely productions; but they afford no adequate preparation for scanning the devices of ingenious machines. Few fine gentlemen, however much they may have been distinguished by academical honours, have any accurate conception even of the mechanical and physical mysteries shrouded within their watch-case; and fewer still can recognise the beauty, wisdom, and beneficence embodied in those factory machines which now bear up their country through all the financial embarrassments which have been created by its classical statesmen, making it triumph over an invidious world, which,

more justly afraid of its peaceful industry than of its military prowess, holds Watt and Arkwright in higher reverence than all its proud patricians.

From this neglect of the practical sciences in the education and studies of English gentlemen, it happens daily, that undue encouragement is given to empirical projectors, that false judgments are formed concerning "enterprizes of great pith and moment," that the most absurd questions are put to witnesses by the members of parliamentary committees, that the most irrelevant or inconsistent answers are recorded in their reports, and that the criticisms of many of our periodical writers on works of a scientific cast are preposterous in the extreme, praise being lavished on the gossip compiler because he exacts no intellectual effort from the common run of readers, but withheld from the experimental inquirer and discoverer of new facts, whose researches tend to raise the standard of public thought, and to enlighten the paths of national industry. Thus they do double injustice; by undeserved obtrusion of frivolous books on the public eye, and by casting as far as they can, a transient shade over others of solid merit. The evil, indeed, is of no long duration, for substantial knowledge will outlast vague verbiage; but it betrays an unsound state of mind, in a country so dependent as this is upon the application of science to the arts of life—to disparage or undervalue it, because it lies above the routine of novel reading, and may cost a little pains to comprehend. Many an Aristarchus in literature would be sorely puzzled to understand the simplest implements of modern manufacture; for if the mind be not opened in youth by such studies, it becomes imper-

vious to them when its faculties lose their pliancy with advancing years. They should, therefore, form an essential part in the education of all classes of society; of the noble and rich, as well as the humble artisan.

Academical philosophers have been long wont to regard the polished instruments of their minute researches in pneumatics, optics, and astronomy, as the most exquisite specimens of mechanical skill, and to consider the larger machines subservient to commercial industry, as of a far less refined and elegant description. Yet a dispassionate judge of mechanism, who should now compare the most exquisite apparatus of the London or Parisian philosopher, with that of the Manchester tool-maker or spinner, would arrive at an opposite conclusion; for there is certainly no instrument made for the purpose of pure science which can compete in truth of adjustment, delicacy of finish, or elaborateness of design, with the planing machines, the bobbin-and-fly frames, the bobbin-net machine, or the self-acting mule-jenny. The spirit of factory invention has, in mechanism at least, given to the Lancashire mind and fingers a decided superiority over the nicest handicraft artisan of the metropolis, and has changed their old contemptuous term of country-work, into one of genuine eulogium. The tiny bobbin and carriage* of the bobbin-net lace frame would puzzle a London workman to make with due delicacy of form and mobility of adjustment in the course of many hours, and would thereby, at least involve an expense of a crown; but it is made with the precision of a mathematical instrument by the factory operative, in the course of a few minutes, and at a cost of only *threepence*.

* See Plate IX.

The student, therefore, who is solicitous to learn the resources of mechanics, must not stop short at the frivolous and inoperative models, so extravagantly bepraised in schools and colleges, but investigate the admirable engines of the cotton trade. Here he will find a series of organs, instinct with intellectual purpose, conspiring to form fabrics inimitable by the most dexterous hand, and working for years with undeviating promptitude. In complexity, as well as perfection of organization, the factory machines surpass all others, just as the human body does a zoophyte.

Our fine spinning-mills are, as Mr. Tuffnell justly observed, the triumph of art, and the glory of England*, they need fear no competition, nor are they, in fact, objects of foreign rivalry. The delicacy of their machinery, the difficulty of keeping it in order, the dexterity of their hands, and the limited and fluctuating demand for their products, are well known to other nations. Of the perfection at which the art of spinning has now arrived in Manchester, a wonderful specimen was a few days ago given me by Thomas Houldsworth Esq., M. P.:—yarn, spun in his magnificent factory for the French weavers, of which a single pound contains 450 hanks of 840 yards each, the whole, therefore, extending 215 miles in length, or nearly the distance between London and Paris. The Sea-island cotton wool, from which the yarn is made, is of exquisite quality; consisting of regular cylindric filaments, about one three-thousandth of an inch in diameter, as measured in the micrometer microscope.† The thread itself is only one three-hundredth of an inch thick,

* Supplement to Factory Commission Report.

† See Vol. i. p. 82, fig. 9.

being much finer than a human hair. The tissues made of it will surpass the far-famed robes of Dacca, styled in Oriental hyperbole—the *woven wind.*

May I be permitted to conclude with the general observation, that there is no greater act of injustice, none more detrimental to society, than to withhold or withdraw the meed of renown from the real benefactors of our race.

"Quique sui memores alios fecêre merendo."—*Virgil.*

A desire to possess the esteem and gratitude of our fellow creatures, though not the highest, is yet one of the most legitimate motives of meritorious exertion; one which should never be wantonly repressed by giving currency to either contemporary or posthumous calumny against a useful citizen. Under a conviction of the moral importance of this maxim, I have taken considerable pains to investigate anew the early inventions of our factory system, and to award the share of commendation justly due to their respective authors. My researches have been altogether dispassionate, influenced by neither local nor party bias, but solely by the love of truth and fair dealing. They have led me to conclude that the genius of Sir R. Arkwright has been most unduly depreciated in some modern publications, and that it deserves to hold, as formerly, a pre-eminent place in the temple of English fame. No one ever denied him the praise of sagacity and prudence in completing his new system of industry, which has made the world tributary to England, upholding its energies amidst wars unparallelled in expenditure. Would a man of his sound discretion, in claiming parliamentary protection for his patent, against a partial decision of a court of

law, have appealed by name to prior inventions, as he did in his *case* to the patent of Paul, if he had stolen from that source, as his modern detractors insinuate or, indeed, if there had been any true similarity between them? In such circumstances his very appeal for redress would have ensured his condemnation.

It is therefore obvious that if Arkwright had perchance looked into the original specification of Paul, which is not likely, for it was so completely buried in oblivion, that his antagonist lawyers, in the course of their elaborate investigations during two Chancery suits, never alluded to it, he must have seen its impracticable structure, and essential difference from his own operative machine, as I have demonstrated at page 216 *et seq.* of the present volume.

NOTE TO PAGE VIII OF THE INTRODUCTION.

But for the regenerating functions of the Poor-Laws Amendment Act, the manufacturing industry of England, and especially its most fruitful field, the cotton trade, would have soon fallen under the same blight as the agricultural had done, and "have eventually shrunk under the freely expanding growth of rival nations. That master-piece of human legislation, framed, it is said, in a great measure, by our all-accomplished jurist, N W. Senior, Esq, Professor of Political Economy in Oxford, was passed with most triumphant majorities in both Houses of Parliament. There was but one economist in Europe, of any note, who did not hail it with delight as the harbinger of a brighter day to the morals, agriculture, and manufactures of England His furious tirades and false predictions may be seen in the London Courier, of May 5, 7, 10, 12, 13, 14, 16, 19, and 24, 1834 They are instructive, but do not come within the scope of the present Work.

THE

COTTON MANUFACTURE.

BOOK I.

ORIGIN AND PROGRESS OF THE COTTON MANUFACTURE IN ITS HANDICRAFT STATE.

THE object of this work is to describe cotton in its various forms, from the development of its filaments in the seed-vessel of the plant, through their several mechanical combinations, till they compose a web of exquisite beauty. I shall first, however, present a view of the history of the manufacture of cotton from its long but graceful pupilage in the plains of Hindostan, till its recent growth into a gigantic manhood under the fostering genius of Great Britain.

The wool-bearing shrub, called Gossypium by botanists, would be universally regarded as a miracle of vegetation, did not familiarity shamefully blunt the moral feelings of mankind. This singular class of plants has been largely distributed all over the torrid zone, a conspicuous gift of Providence to its inhabitants, destined to afford them, in its fleecy pods, a spontaneous and inexhaustible supply of the clothing material best adapted to screen their swarthy bodies from the scorching sunbeam, and to favour the cooling influence of the breeze, as well as cutaneous exhalation. While

the tropical heats change the soft wool of the sheep into a harsh, scanty hair, unfit for clothing purposes, they cherish and ripen the vegetable wool, with its slenderer and more porous fibres, admirably suited to Southern, as the grosser and warmer animal fibres are to Northern India. No sooner does the cotton plant arrive at maturity, than its swollen capsules burst, with an elastic force, in three or five gaping segments, in order, as it were, to display to the most careless eye their white fleecy treasure, and to invite the hand of the observer to pluck it from the seeds, and to work it up into a light and beautiful robe. Thus held forth from the extremity of every bough, by its resemblance to sheep's wool it could not fail to attract the notice of the first tribes which migrated southwards, after the primitive dispersion of the human family on the plain of Shinar; and would naturally lead them to employ it for making raiment—an art undoubtedly known to the sons of Noah. Accordingly the earliest accounts given by historians and travellers of the intertropical nations show them to have been acquainted with the fabrication of cotton cloth. Of all textile materials, cotton is the most easy to twist into a fine thread, a process which may be performed upon the plucked filaments with the fingers and thumbs alone. How readily these threads may be converted into a web, the simple weaving machine of the Hindoo sufficiently attests.

It would appear that the older Egyptians were unacquainted with cotton, for no traces of its peculiar fibres can be found among the swaddling bands so profusely rolled round the ancient mummies, nor are there any paintings of the cotton shrub upon the

tombs of Thebes, where accurate representations of flax occur in its different states of growth and manufacture. Linen was, in fact, the clothing staple of that industrious people; held in such esteem as to be used as a raiment by royalty, and diligently imitated by the neighbouring nations. The Jews first, and afterwards the Greeks and Romans, learned to manufacture linen from the Egyptians. If we consider how near to Syria and Egypt are the regions where the cotton shrub was indigenous, we may feel surprise that it should have remained so long unknown or neglected by nations to whom it would have furnished a far cheaper and more comfortable article of dress than the flax plant. Indeed the insulation of the cotton manufacture in India, for so many centuries after a considerable intercourse with the East had been established by the conquests of the Greeks and the Romans, is one of the most singular phenomena in the history of man, and shows how little inquisitive these highly-celebrated people were concerning the arts conducive to personal comfort.

War was, in reality, the staple trade, the sole factory system of the ancient world, so all-engrossing indeed in the Roman Empire, as to leave its citizens hardly any choice of a reputable handicraft of a purely pacific description. Nothing remained to the philanthropist, born to live by manual toil, but to select such a calling as, though necessarily connected with the universal business, would however tend to assuage its miseries. This was, in particular, the case with the trade of making tents to shelter the sick and harassed soldiery. As it could procure a decent livelihood to a skilful hand in every district, and needed but a few

portable tools, it was peculiarly suited to those artisan missionaries who travelled from region to region to regenerate the moral condition of mankind. Accordingly the Apostle Paul was a tent-maker, and indefatigable in his trade. He combined in his example and writings the best prudential lessons for the present life with the sublimest doctrines of the life to come. The principles of industry never had indeed so cogent an expositor as St. Paul. He commanded that if any would not work, neither should he eat, and he acted up to his own injunctions; for he ministered with his hands not only to his own necessities, but to them that were with him, showing how that, so labouring, they ought to support the weak, and remember the words of the Lord Jesus, how he said, "It is more blessed to give than to receive." How would modern industry thrive were it administered in conformity with this noble precept of the inspired economist; "Owe no man anything but to love one another!"

Generally speaking, the interests of the bulk of mankind were entirely sacrificed in the ancient military governments to the pride and luxury of a small number of chiefs, who, under the names of centurions, tribunes, consuls, archons, satraps, and kings, monopolized the means of enjoyment, and despised the mechanic arts.

In several of the ancient states of Greece, says Adam Smith, foreign trade was altogether prohibited; and in many others the employments of artificers and manufacturers were considered as hurtful to the strength and agility of the human body, as rendering it incapable of those habits which their military and gymnastic exercises endeavoured to form in it, and as

thereby disqualifying it, more or less, for undergoing the fatigues, and encountering the dangers, of war. Such occupations were considered fit only for slaves, and the free citizens of the state were prohibited from exercising them. Even in those states where no such prohibition took place, as in Rome and Athens, the great body of the people were, in effect, excluded from all the trades which are now commonly exercised by the lower sort of the inhabitants of towns. Such trades were at Athens and Rome all occupied by the slaves of the rich, who exercised them for the benefit of their masters; whose wealth, power, and protection, made it almost impossible for a poor man to find a market for his work, when it came into competition with that of the slaves of the rich. Slaves, however, are very seldom inventive; and all the most important improvements, either in machinery, or in the arrangement and distribution of work, which facilitate and abridge labour, have been the discoveries of freemen. Should a slave propose any improvement of this kind, his master would be very apt to consider the proposal as the suggestion of laziness, and of a desire to save his own labour at the master's expense. The poor slave, instead of a reward, would probably meet with much abuse,—perhaps with some punishment. The finer sort of manufactures among the Greeks and Romans were excessively dear. The price of linens and woollens was extravagant, compared to our standards. Hence their dress was little varied, as the costumes of the antique statues show; and it was made very loose, so as to last for a long time.

The ancient geometers, best qualified by their

genius to improve the productive arts, held them far too cheap to bestow any thought upon them.' The wonderful mechanical resources displayed by Archimedes, in defending Syracuse against the assaults of the Romans, proved him to have been eminently endowed with the constructive faculty, so capable, when rightly applied, of aiding the weakness of man in providing for his innumerable wants in food, clothing, and household accommodation. But according to his admirer, Plutarch, he disdained all such palpable problems, considering every art that ministers to common uses as mean and sordid, and placing his whole delight in those intellectual speculations which, without any reference to the necessities of life, have an intrinsic excellence resulting from abstract truth and demonstration. Plato was no less hostile to experimental researches. He inveighed even against Archytas and Eudoxus, the most eminent practical engineers of antiquity, for realizing their theorems in models of machines; thus, as he alleged, debasing geometry by transferring it from incorporeal to material objects which require manual labour, and appertain to servile trades beneath the notice of freemen.

How different is the spirit of modern philosophy since it was first directed into the path of utility by Galileo, Bacon, Pascal, and Newton! It places its chief delight and honour in investigating the relations of number, figure, and all material substances, in order to apply the resulting discoveries to assuage the evils and to multiply the enjoyments of social life. In its modern familiarity with the sublimest of speculations, that of the equilibrium and movements of the celestial bodies, mechanical science does not,

however, disdain to study the most humble machine of manufacturing industry; and, indeed, may hold many of them up to the admiration of the transcendentalist, as the happiest achievements of the human mind. Should any one ask where; let him enter a cotton-factory, and look around.

Herodotus, who wrote upwards of four centuries before the reign of Augustus, notices distinctly the cotton fabrics of India: and says that a species of plant in that country bears a fruit full of a wool superior to that of the sheep, with which the natives make cloth for their garments. The general use of cotton as an article of dress indicates that it was no novelty in his time, but that it had been established at a very early date, as we have already suggested. This statement of the father of history is confirmed by Arrian, in the account which he gives of the voyage of Alexander's Admiral, Nearchus, who, in sailing down the Indus, and along the coasts of Persia to the Tigris, had occasion to observe that the clothing of the Hindoos was a sort of linen made from a stuff which grew upon trees. He calls the cotton shrub *tala*, and says that the Indians' garments hung down to the middle of their legs, and that they covered their heads with turbans of cotton cloth. On the authority of the same great navigator, Strabo speaks of the printed cotton robes, or calicoes, with much commendation for the variety of their beautiful hues. This writer, who was contemporary with our Saviour, alludes to the cultivation of the cotton shrub, and the fabrication of cotton cloth in the Persian province of Susiana.

About half a century later Pliny presents us with a

more detailed description of the cotton plant:—"In Upper Egypt, on the side of Arabia, grows the shrub called by some gossypium, and by others xylon, from which cloths called xylina are woven. The plant is small, and produces a fruit, like a walnut, which contains a woolly down, that may be spun into yarn. This cloth merits a preference over all others for its whiteness and softness; and is made into beautiful robes, which the priests of Egypt delight to wear."

When we call to mind the extensive traffic which the luxurious tastes of Rome occasioned with the Eastern world, we must feel surprised that such scanty notices exist among Roman writers of the beautiful cotton robes of India. Their trade with that remote region was said to have drained the empire every year of more than four hundred thousand pounds; and on this business, one hundred and twenty ships sailed annually from the Arabian Gulf, stretching out boldly from Oceles, at its mouth, across the great ocean to the coast of Malabar. They returned with the eastern monsoons, bringing back the spices and other rich merchandise of the continent and the islands, from the general mart, Musiris, to which the Indian vessels carried them for sale.

The *sericæ vestes*, or semi-transparent robes, with which the Roman ladies took so much pleasure in veiling their beauties in the decline of the empire, were most probably fine Indian muslins imported into Italy through the territory of the Seres—the Bochyra of modern times. It is known that a considerable traffic was then carried on through Alexandria, between Rome and the East, for the productions of India, the chief mart of which was Malabar.

Virgil alludes very beautifully to the cotton plant in the following lines in the second Georgic:—

> Quid nemora Æthiopum, molli canentia lana?
> Velleraque ut foliis depectant tenuia Seres?

"Shall I sing of the groves of Ethiopia, hoary with soft wool; and how the Seres comb out the delicate fleece from among the leaves?" can surely apply to nothing but a shrubbery of cotton plants.*

Dr. Vincent, however, in his learned commentary on Arrian, suggests, that the word *serica*, in the ancient writers, refers to silk; but Salmasius considers it, and in my opinion more justly, as alluding to cotton.

The word *cotonea*, which occurs several times in Pliny's Natural History, means clearly the quince-apple. In his 23rd book, c. vi., 54, we find boiled quinces prescribed as the preferable mode of using this apple—*cotonea coctu suaviora.*

The *cydonia mala* is another synonyme for quinces. In the passage quoted in the foot-note, Pliny likens the capsule of the cotton-plant to the quince-apple in size, and adds, that it bursts on being perfectly ripe, and displays its woolly pile, from which a precious kind of linen raiment is made. These wool-bearing trees are called *gossympinoi*. Hence the Linnæan name, *Gossypium* †. The Tylos of Pliny, where these

* See Note A, at the end of the volume.

† Tylos insula in eodem sinu est, repleta silvis . . . Ejusdem insulæ excelsiore suggestu lanigeræ arbores, alio modo quam Serum. His foliis infecunda; qui ni minora essent vitium poterant videri. Ferunt cotonei mali amplitudine cucurbitas, quæ maturitate ruptas ostendunt lanuginis pilas, ex quibus vestes pretioso linteo faciunt. Arbores vocant gossympinos. C. Plinius, Nat. Hist., lib. xii., c. x.

trees were found, is, according to Vincent, an island in the Persian Gulf*.

Instead of *gossympinoi*, Herodotus and Theophrastus use the simple expression, *wool-bearing trees—dendra eriophera.*

Of the Egyptian cotton shrub Pliny gives so very explicit a description as to render it surprising that no trace of cotton cloth has been found among the mummy bandages hitherto unrolled in England†. Such robes were, perhaps, too valuable to be buried with the dead body, and might be kept as heir-looms from generation to generation.

The 'Periplus Maris Erythrei' was probably written at, or a little before, the time of Pliny, the naturalist, —not by the celebrated historian of Alexander, but by another Arrian, most likely an Egyptian Greek, who went on a mercantile expedition, about the beginning of the second century, down the Red Sea, and along the whole extent of the Indian coasts, and who has left a record of his voyage, under the above title. He tells us that the Arabian trading-vessels brought Indian cottons to a port in the Red Sea, called Aduli; and that Barygaza, the Baroche of modern geographers, near the north-west coast of India, was a mart of cotton goods of many kinds; whence common cottons, calicoes, and muslins, plain and flowered, of

* Voyage of Nearchus, p. 321.

† Superior pars Ægypti in Arabiam vergens gignit fruticem, quem aliqui gossypium vocant, plures xylon, et ideo lina inde facta xylina. Parvus est similemque barbatæ nucis defert fructum, cujus ex interiore bombyce lanugo netur. Nec ulla sunt eis candore mollitiave præferenda. Vestes inde sacerdotibus Ægypti gratissimæ. Plin., lib. xix., c. i. No juster eulogium could be written on the cotton-plant and cotton goods by a modern naturalist. *See the translation, p. 8.*

Indian manufacture, were exported to various countries. It appears, moreover, that Masalia was at that time famous, as the same place has continued to be ever since, under its native name of Masulipatam, for cotton fabrics. The Bengal muslins were then celebrated under the title of Gangitiki, bestowed on them by the Greeks, because they were made near the banks of the Ganges.

The stationary condition in which the arts of India have remained since the earliest times is remarkably exemplified in the case of Baroche, a town in the Guzerat, which has been described by Forbes, in nearly the same terms as by the ancient author of the 'Periplus.' The cotton trade of Baroche is very considerable, and the manufactures of this valuable plant, from the finest muslin to the coarsest sailcloth, employ thousands of men, women, and children, in the metropolis and the adjacent villages. The cotton cleaners and spinners generally reside in the suburbs, or poorahs, of Baroche, which are very extensive. The weavers' houses are mostly near the shade of tamarind and mango trees, under which, at sunrise, they fix their looms, and weave a variety of cotton cloth with very fine baftas and muslins. Surat is more famous for its coloured chintzes and piece-goods. The Baroche muslins are inferior to those of Bengal and Madras, nor do the painted chintzes of Guzerat equal those of the Coromandel coast.

In the downfall of the Roman empire arts and commerce perished. At this dark period there are merely a few incidental notices of the cotton manufacture in the East. Omar, the successor of Mahomet, is described as "preaching in a tattered cotton gown,

torn in twelve places;" and Ali, his fellow-fanatic, who became caliph after him, "went on the day of his inauguration to the mosque, dressed in a thin cotton gown, tied round him with a girdle, and a coarse turban on his head." We may hence infer that cotton cloth was a common material of dress in Arabia at the time of the Hegira, and had probably been so for many generations, as the soil was too arid for the production of flax, and the climate too hot for favouring the growth of a soft fleece upon the sheep.

There is little doubt that the Mahometans carried along with their conquests into the western world the arts of growing and working cotton; and introduced also into India certain modifications of the ancient practices of that country, in spite of the unchangeableness due to the distinction of castes. The first step in the cotton manufacture is the separation of the downy fibres from the seeds, which was originally effected no doubt by the fingers alone, but for a very long period it has been done in Hindostan by a pair of rude rollers. The second step is the thorough opening up of these fibres, by the elastic stroke of a bow-string. It deserves special notice that the bow-string operation, though now a constant part of the Indian process, is never executed by Hindoos, but by Mahometans, proving it to be an innovation of their Mussulman conquerors. The hard twisted warp for certain fabrics is also spun by Mahometans—spinning the softer and more delicate yarns being the province of the Hindoo women, and constituting almost the sole occupation by which they can earn the trifle needed for the supply of their wants.* The cause of the early perfection which the muslin manufacture attained in India must

be sought for in the exquisitely-fine organization of the natives of that region. Their temperament realizes every feature of that described under the title *nervous* by modern physiologists.

A marked excess of sensibility in the ordinary transactions of life; delicate fibres, a soft and fine skin, pliant limbs and fingers, a pathetic look; a feeling of anxiety attendant upon the play of the organs; lively sensations occasioned by very slight causes; are the symptoms of this temperament: they all predominate in the Hindoo constitution; and so qualified it for the delicate textile manufacture of cotton, that they kept, as it were, a monopoly of it for several thousand years.

The next authentic account of the cotton manufacture of the East is given us by Marco Polo, in the thirteenth century. In the vicinity of Mosul, now the capital of the Turkish pachalik, upon the western bank of the Tigris, opposite the ancient Nineveh, "there are places," says this great traveller, "named *Mus* and *Mareddin*, where cotton is produced in vast abundance, of which they prepare the cloths called *boccasini*, and many other fabrics." From Mosul the Italian words *mussolo** and *musselino* are derived, whence mousseline and muslin, in French and English. Ives states, in his Journey, that "this city's manufacture (or trade) is mussolen, a cotton cloth, which they make very strong, and pretty fine, and sell for the European and other markets." It was therefore a species of calico, so named from the city Calicut, in the East Indies. In 'Menagio's Origini della Lingua

* Sorta di tela bambagina, così detta dal nome del paese dove per lo più ella si fabbrica.

Italiana' we find, under the word *Mussolo*, the following explanation:—" *Al Mussoli* is a region in Mesopotamia, in which are woven webs of cotton, of exceeding beauty, which are called *Mussoli* among the Syrian and Venetian merchants, from the name of this region *." It is probable that Marco Polo occasionally confounded the silk with the cotton manufacture. The boccasini mentioned above was most likely a species of fine white and soft cotton cloth, as it is called, in the Italian translation of 'Ramusio,' boccasini *di bambagio*, or *of cotton.*

Cotton, says Marco Polo, grows abundantly in Persia, and also in Guzzerat; in which latter place it is produced from a tree about six yards high, which bears twenty years; but the cotton taken from trees of that age is not adapted for spinning, but only for quilting. Such, on the contrary, as is taken from trees of twelve years old, is suitable for muslins, and other manufactures of extraordinary fineness. In Cambaia, also, there is abundance of cotton cloth, as well as of cotton in the wool; and a great quantity of indigo is manufactured †.

At the city of Kue-lin-fu (Kien-ning-fu, in the province of Fo-kien), says Marco Polo, cottons are also woven of coloured threads, which are carried for sale to every part of the province of Manji: probably this cotton was not dyed on purpose, but was the native

* Al Mussoli est regio in Mesopotamia, in qua texantur telæ, ex bombyce valde pulchræ, quæ apud Syros et apud mercatores Venetos appelantur *Mussoli*, ex hoc regionis nomine.

† "Qui," says Barbosa, "si lavorano assai tele e panni di gotton bianchi, sottili e grossi e di varie sorte tessuti et dipinti." Here we see the antiquity of the printed calico manufacture.

orange-coloured cotton, called Nam-king by Van Branam.

In Murphili (the Masuli-patam of modern geographers), says Marco, they manufacture the finest cottons that are to be met with in any part of India. It has been, in fact, always celebrated for its chintzes. Of the kingdom of Malabar he says, "Here the finest and most beautiful cottons are manufactured that can be found in any part of the world." Hamilton has confirmed this statement in speaking of Raja-pore, a place near Gheria, observing, that "the country thereabouts produced the finest muslins and betillas in India," p. 243. It appears from the former authority that at that period various kinds of cotton goods were manufactured in the island of Socotra, then inhabited by a Christianized people, subject to a patriarch, residing at Badhdad. Astley, in his collection of old voyages, says—"Next day," speaking of a voyage performed in 1608, "standing off to sea, they met with a Guzerat ship, laden with cotton, calicoes, and pentathoes (chintzes), bound for Aden." Marco Polo was a Venetian, who travelled in the thirteenth century, from the year 1260 downwards, was confidentially employed in the service of the Tartar conqueror of China, and returned in the year 1295, after having visited a great many countries of Asia. His credibility is undoubted. The manuscript was first circulated in 1298, at Genoa, where he was confined as a prisoner of war, having been taken in a naval action with the Genoese fleet, against which he had fought bravely as captain of a Venetian ship, but was ill supported by his countrymen.

It is probable that in the time of Marco Polo the

cotton manufacture was just beginning to be introduced into China, for, in noticing the productions of many other parts of that empire, in which he held a high official rank, and enjoyed perfect freedom of observation, he makes no mention of cotton goods.

We know from other sources that the Emperor Ou-ti, of the small dynasty of Leang, who ascended the throne in the year 502 of the Christian era, had a robe of cotton. Towards the end of the seventh century the cotton shrub began to be cultivated in the gardens of the capital of China. *The whole town is full of cotton flowers,* says a Chinese poet of that time, in verses written upon the summer season. It was, however, only for the sake of the flowers that the plant was then cultivated. This fact will appear extraordinary, if we bear in mind that the court held in high estimation the cotton garments which were presented to their king by foreign ambassadors. Nothing shows in a more striking manner how blind the cleverest nations sometimes are to their best interests, and how much in all ages a peculiar genius and an ardent zeal are required to rouse the multitude from their indifference about new things; to make them see clearly what is before their eyes, and to give them energy to turn their labour and dexterity to account. We can hardly reconcile such backwardness with the supposed keenness of the Chinese temperament. It was not till the eleventh century that the herbaceous cotton plant passed from the parterres and gardens of China into the fields, and this only in a few districts of Kiang-Nan. As to the cotton-tree, it was known only in their books, till the dynasty of the Mongul Tartars, called Yuen in the country, who conquered it about

1280, and reigned thereafter eighty-eight years. The emperors of that dynasty took every possible pains to extend and render fashionable the culture of cotton plants of every kind; and, in fact, imposed on several great provinces an annual tribute of cotton. But this business was looked upon with an evil eye by the aborigines, and was much disliked, as interfering with corn-crops, with their forest-trees, and with the silk manufacture, so long cultivated among them. The nation felt itself aggrieved by the new-comers, and zealously tried to rouse the old proprietors to maintain the established usages of the people. But, eventually, these prejudices were overcome by the care and liberality of the government. All the provinces betook themselves diligently to the cultivation of cotton; and at present every nine persons out of ten are dressed in cotton cloth. The dynasty of Ming, the immediate predecessor of the reigning family, had the honour of effecting a revolution so conducive to national comfort.

In consequence of a dearth of provisions in China, about sixty years ago, an imperial mandate was issued to convert to the cultivation of corn a considerable portion of land then appropriated to the cotton plant; since which time the Chinese have been accustomed to import large quantities of cotton wool. Sir George Staunton found all the lower orders of the Chinese, of both sexes, dressed in cottons, and the upper orders in silks.

Spain, which had received the cotton manufacture along with its Mahometan masters, continued for many centuries to cultivate it with much success. The cotton plant still grows wild in many parts of the

Peninsula. De Marlès asserts that the Moors, who were mingled with the Arabs at the Spanish conquest, brought with them the husbandry of rice and cotton, as well as that of the mulberry-tree and the sugar-cane. From the narratives of subsequent Saracenic historians it would appear that the cotton manufacture was prosecuted to very considerable extent by the Spaniards during the thirteenth, fourteenth, and fifteenth centuries. Barcelona was famous in particular for its cotton sailcloth, of which it supplied great quantities to the squadrons stationed off its harbour. The term *fustaneros,* from which our word *fustian* comes, was first given in Spain to the weavers of cotton goods of a stout make, as the Spanish word imports substantial. Cotton paper seems also to have been first made by the Spanish Arabs; a paper was afterwards manufactured by them from linen rags at Valencia, which was much admired by the literary men of the time. The religious antipathy, however, which existed between the Moors and the Christians, prevented the propagation of these Oriental arts westward, so that, when the Saracens were expelled from Spain, the manufactures of this country relapsed into a barbarous state.

The following interesting account of the cotton husbandry of Spain under the Moors is given by M. Lasteyrie in his treatise on the cotton plant.

Eben el Awam, who lived in the twelfth century, and who farmed a small property near Seville, in a delightful situation, which we have gone over and examined with a lively interest, has described not only the mode of cultivating cotton employed in Spain, but also the methods followed in a great portion of

the countries which were at that period under the dominion of the Moors or Saracens. This Arabian writer has copied a part of his work from the ancient Egyptian, Greek, Persian, and Arabian authors, whose pages have since become the prey of time and human barbarism. This monument of ancient agriculture is the more valuable, as we do not find in the Greek and Roman writers any traces of the husbandry of the cotton plant, whence we may conclude that it was not established in Greece, Italy, Sicily, and Malta, and the other coasts of the Mediterranean, till the Mahometans, on the conquest of these regions, brought the arts of the Eastern world with them.

The Arabs, with less taste in the fine arts and in literature than the Greeks and Romans, appear to have surpassed the former and to have at least equalled the latter in agriculture. The precepts of Eben el Awam upon cotton plantations are contained in the twenty-second chapter of his *Book of Agriculture*. He says it is sown in Arabia Petrea, Egypt, at Ascalon and Bassora, on sandy grounds subject to irrigations; that in Sicily, as well as on the coasts of Spain, it is raised upon the inferior soils, which are found sufficiently good for it, and that the roots are transplanted, as is done with potherbs in a garden. They are set at eight palms' distance from each other, because in those countries the shrubs rise to the height of the fig-tree, which is usually from fifteen to twenty feet, and it endures for several years. It is treated in the same manner as the vine, and it yields every year a good crop by means of ploughings and irrigation. He says that the inhabitants of Syria are wont to prepare a year beforehand the land intended for cotton,

enriching it with plenty of dung, and freeing it from weeds. They then irrigate it, and as soon as it is drained they make holes an inch and a half deep, and a palm and a half asunder. Into each hole they put two or three seeds, which they cover with a little soil; and whenever the plant has risen a palm from the ground they repeat the irrigation, which is, indeed, done as often as is thought requisite; and in general, according to another Arabian authority, every fifteen days till the beginning of the month of August, the period when the capsules form. Then all further watering must be avoided, in order to favour the formation of the cotton fibres. If the vegetation be too active, the bottom of the plant must be beat with a stick. M. Lasteyrie properly finds fault with this practice, and suggests that it would have been better to prune off the extremities of the too-luxuriant branches. Thus, adds the Arabian, the juices do not run to waste; but are, on the contrary, concentrated on the fruit, so as to improve its quality. The harvest occurs in the month of September, when the capsules begin to open, and when the down is just seen peeping out of them. They ought to be plucked in the morning, when still damp with the dew of night, and deposited in a spot sheltered from the sunbeam, in order to preserve them in a somewhat damp state, when the cotton must be removed from the seeds by the fingers. The wool is afterwards exposed to the sun till it is thought to be dry, and then packed up for use. Aben Hajaij, another Arabian writer, says that the cotton plant can be cultivated with advantage only in islands and on level plains.

Documents exist in Biscelia, dated in 1050, which

prove that the priests of San Adveno were authorized to let their church lands for the growth of cotton plants; and there is other evidence of the existence at the same time of the cotton husbandry in Sicily. In Calabria the plant was biennial, and produced the best crop the second year *.

In 'Ramusio's Viaggi,' or collection of voyages, a copy of the original edition of which, printed early in the sixteenth century, exists in the library of the British Museum, there are several notices showing that the cotton manufacture was very extensively established, before that period, all over the southern shores of the Mediterranean. At Fez the natives raised a large quantity of cotton, and the townspeople were very generally weavers of cotton cloth, of a truly exquisite and beautiful texture †.

Hunain, a small African city on the Mediterranean, frequented in the fifteenth century by the Venetians, is spoken of with high commendation in Ramusio's volume, on account of its eminence in this manufacture. "The inhabitants were a noble civilized race of men, and almost all engaged in the production of cotton or cotton cloth ‡."

Of Amon, a place five days' journey from Damascus, it is said that a very great quantity of cotton was grown at it.

* Atti del Real Instituto d'Incorraggiamento alle scienze naturali di Napoli, Tomo II., 1818. This curious notice was politely brought before me by the librarian of the Jardin des Plantes in Paris.

† Si raccoglie gran quantità di bambagio, et gli habitatori della città sono per lo più tessitori di tele bambagine, molto sottili nel vero et molto belle.—Giovanno Lioni Africano Descrittione della Africa.

‡ Gli habitatori furono nobili et civili et quasi tutti lavoraron bambagio o tele.

According to Odoardo Barbosa, of Lisbon, who made a voyage to Southern Africa in 1516, the Caffres then wore cotton dresses, *drappi di bambagio*, denoting a high state of civilization for that race of people. At Cefala, he says, the Moors grow a large quantity of fine cotton, and weave it into cloth, which they use in the white state, from their being unable to dye it, on account of the want of colouring stuffs.

From Macpherson's 'Annals' it appears that cotton cloth, woven on the coast of Guinea, was imported into London from the Bight of Benin—in the year 1590; a fact corroborative of the above testimony.

The modern travellers who have explored the interior of Africa concur in showing that the cotton plant is indigenous to that continent, and that the wool is spun and woven into cloth, which is used for raiment by the inhabitants of every class and every region. From the beauty of the dye, and the designs observed on some of their cotton dresses, it may be justly inferred to be a manufacture of very ancient standing.

The state of the New World relative to cotton is very remarkable. When the Mexicans were first invaded by their European conquerors they had no sheep's wool, nor common silk, nor linen, nor hemp, but they supplied the want of wool with cotton, that of silk with feathers, and with the hair of the rabbit or hare. Of cotton they made large webs, and as delicate and fine as those of Holland, which were therefore highly esteemed on their importation into Europe. A few years after the conquest a sacerdotal habit of the Mexicans was brought to Rome, which, as Boturini affirms, was uncommonly admired on account of its fineness and beauty. The Mexicans

wove cloths with different figures and colours, representing various animals and flowers. We have seen some beautiful mantles of this kind, says Clavigero, which are still preserved by some lords. With cotton also they interwove the finest hair of the bellies of rabbits and hares, after having spun and dyed the thread; of these they made the most beautiful clothes, and, in particular, winter waistcoats for their grandees. A few days after Cortes arrived in Mexico he despatched to the Emperor Charles V., in July, 1519, among other rich presents, a variety of cotton mantles, some all white, others checkered with white and black, or red, green, yellow, and blue; on the outside rough, like a shaggy cloth, and on the inside without either colour or nap. A number of under-waistcoats, handkerchiefs, counterpanes, tapestries, and carpets of cotton, were sent to Europe. All these articles were, according to Gomara, more valuable for the workmanship than the materials. *The colours*, he says, *of the cotton were extremely fine, and those of the feathers natural. Their works of cast metal are not to be comprehended by our goldsmiths.*

The Mexican men used to wear two or three mantles, and the women three or four vests, and as many gowns, putting the longest undermost, so that a part of each of them might be seen. The lords wore in winter waistcoats of cotton, interwoven with soft feathers or the hair of the rabbit. The upper ranks in general used counterpanes of cotton and feathers.*

We have thus seen that from a very remote period

* Clavigero, Book VIII. Among the mummy-cloths brought from the ancient tombs at Arica, in Peru, by Lord Colchester, in

the natives of the tropical countries of Asia, Africa, and America, were well acquainted with the cotton

1831, and now deposited at the British Museum, three different textile fabrics may be distinguished.

1. A white flimsy web, like the coarsest calico at present used for linings in this country.
2. A coarse plaid stuff, woven in red and brown stripes.
3. A yellow fringe-looking stuff. The threads of the last two fabrics are pretty thick; those of the first are much finer.

No. 1 is a cotton cloth, of which the fibres, viewed in the microscope, are remarkably tortuous, like a cork-screw, and very regular in size and form. They resemble the fibres of the *Gossypium hirsutum*, probably the primitive cotton plant of South America.

No. 2 is a sort of worsted stuff, made of the wool of the Vicugna. Its filaments seem to be more minutely indented along the line of the edges than those even of the long-stapled sheep's wool of England, as figured at p. 91 of the *Phil. of Manufactures.*

No. 3 is a texture of the same fleece as No. 2, dyed of an orange yellow, having a few filaments of cotton, carded or mixed in and spun along with it. This mixture is very distinguishable in the microscope.

The application of this instrument to examine animal and vegetable filaments is of ancient date. It was very successfully employed by Ledermüller upwards of seventy years ago, and was illustrated by many fine engraved representations of the serrated structure of the hair of the sea-calf, and other fibrous matters. The celebrated Monge thought he saw in the serrations of wool, and similar hairy substances, the cause of that curious interlacement and condensation which they undergo in the process of felting, used in the manufacture of stuff hats. He promulgated his theory of this operation at considerable length, upwards of forty years ago, in the sixth volume of the 'Annales de Chimie,' whereby he made the serrated structure of wool familiar to every philosopher of Europe, since his memoir was translated into all its civilized languages, and particularly into our popular scientific journals at the time*.

Subsequent researches have shown that Monge's theory requires certain modifications. Though the woolly filaments which constitute the hair and fur of many animals be provided with asperities ("scales like those of fish, or imbricated zones, like the horns of animals," are

* Nicholson's Journal, and Repertory of Arts.

plant, and worked up the woolly down of its pods into useful and ornamental articles of clothing. The

the characteristic phrases employed by Monge), yet they are not susceptible of felting, he thought, if they were straight, because the kneading motions of the operator's hands would make them merely move progressively forwards, and cause no interlacement. This defect in the straight filaments he supposed to be removed by *secretage*, or the application of a solution of nitrate of mercury to the tips of the fur on the skin, which caused these to curl. M. Malard, M. Guichardière, and M. Robiquet, have controverted this theory, by showing that straight hairs, such as those of warren-rabbits, felt very well without *secretage;* while those of the hare and the castor, which are not straighter, require that preliminary process before they will felt. Again, certain straight-fibred sheep-wools, like those of the *beauce*, may be readily felted alone, whilst the Spanish wools, which are naturally curled, cannot be used for making hat-felt. Though the rectilinear form of the fibres be not the sole obstacle to felting, as Monge imagined, yet he undoubtedly was right in regarding the scales or asperities on their surfaces as co-operative towards felting, while they are not its only cause. The hairs of the seal, which present in the microscope a great many asperities or notches, arranged like the teeth of a saw, are not susceptible of being felted. "All the hairy filaments," says M. Robiquet, "viewed in the microscope, present very distinct scales, disposed symmetrically; but affecting sometimes one figure and sometimes another." He considers the flexibility of the fibres towards their tips to be another condition no less essential than the serrations to their felting property. *Secretage* communicates this flexibility, he thinks, by corroding off the natural varnish upon the tips of the hairs. "It is well known, in fact, that wools and hairs, subjected to the action of alkaline leys, readily form a felt; and that this tendency often presents a great obstacle to the working them up *." Hence, adds he, it is not astonishing that wools naturally curled are not fit for felting, because the inflexion should be merely successive, and should increase only in proportion as the felt-

* M. Robiquet, Membre de l'Institut, in the article Feutrage (Felting), published in the Dictionnaire Technologique for 1825. His description is remarkably clear—"Tous les poils, vus au microscope, présentent des écailles bien distinctes et disposées symmétriquement; mais affectant tantôt une figure et tantôt une autre," p. 527. The article from which this sentence is quoted is particularly interesting. A condensed notice of it is inserted at the bottom of page 92 and top of page 94 of my 'Philosophy of Manufactures.'

Europeans alone continued destitute of this admirable industry for many thousand years after it had been possessed by nations whom, from their less warlike polity, or less ferocious disposition, they looked down upon as inferior races, or regarded even as barbarians.

The Portuguese, after their discovery of the passage to India by the Cape of Good Hope, made large importations of cotton-stuffs and muslins into Europe, but did not attempt to establish any manufacture of the kind in their own country. When the Dutch, however, some time thereafter, succeeded in depriving the Portuguese of a part of their eastern colonies, they not only extended the traffic in cotton goods, but, towards the latter end of the sixteenth century began to fabricate them at home. Long prior to this period, a manufacture of indigenous cotton had existed in the southern parts of Italy, where the plant had been cultivated since the eleventh century, particularly along the shores of the gulf of Taranto. From a remote era, ladies of condition in that district occupied themselves in spinning cotton and knitting the yarn into stockings, articles of dress which were greatly admired, and fetched the prodigious price of a guinea the pair. The muslin of the same region was like-

ing goes on; otherwise the progressive motion of the fibres cannot take place.

M. Robiquet informs me, in a polite note, dated December last, that he made the observations on the structure of hairy filaments which are inserted in his article *Feutrage*, in conjunction with M. Lebaillif, who was very skilful in the use of the microscope, and that the most curious species which he saw was that of the otter. The wools which I examined in my achromatic microscope, were sent to me, with a note, dated the 29th of January, 1834, by Messrs. Loughnan and Hughes, of Basinghall-street, through James Cook, Esq., of Mincing-lane.

wise in vogue till towards the conclusion of the last century, when it came to be superseded by the large importations from India, and the superior fabrics of England. In that part of Italy, the soil is said to be so favourable to the culture of cotton, that an English acre will produce, in good seasons, ten cwt. of seed-cotton, which will yield 2 cwt. of cotton wool. A considerable quantity of this product was at one period exported in the raw state*.

The earliest notice of cotton, as an article of English trade, is to be found in Hakluyt's Collection of Voyages. It is copied from a little book, entitled, 'The process of English Policy.' "Genoa," says the author, "resorts to England in her huge ships, called carracks, bringing many commodities, as silk, paper, wool, oil, cotton," &c. This work was printed towards the conclusion of the fifteenth century. Before that period, England was probably supplied directly from the Levant with the small quantity of cotton then wanted, chiefly for candle-wicks. The Genoese lost their monopoly of the carrying trade in 1511, from which time till 1534, says Hakluyt, divers tall ships of London and Bristol had an unusual trade to Sicily, Candia, and Chios, and sometimes to Cyprus, Tripoli, and Baruth, in Syria. They imported thither sundry sorts of woollen cloths, calf-skins, &c.; and imported from thence silks, camblets, rhubarb, malmsey, muscadel, and other wines; oils, *cotton wool*, Turkey-carpets, galls, and India spices. The merchants of Antwerp soon thereafter engrossed the Levant trade, to the exclusion of the English. But after the sack-

* Travels of Charles Ulysses in 1787, published in London in 1795, p. 116.

ing of that city, the English resumed the Mediterranean commerce, and carried it on with great activity; importing, in return, cotton among other articles, according to the statement of Mr. Mann*. It appears from Wheeler, who wrote in 1601, that cotton was brought to England by the Antwerpians from Sicily, the Levant, and sometimes from Lisbon, along with many other precious articles, which the Portuguese imported in those times from India. The merchants of Antwerp obtained cotton goods from Italy before this time, for Guicciardini enumerates fustians and dimities among the valuable articles of import from Milan into the mart of the Netherlands. The people of the Low Countries soon took up this manufacture themselves, and in the subsequent emigrations of the Protestants from that country, during their religious persecution by the court of Spain, they brought it into England, and established it in the towns of Bolton and Manchester. The fustians were valued by Guicciardini at 600,000 crowns, but they were probably a mixed stuff. The consequences of the cruelties exercised by the Duke of Alba, are thus powerfully described by M. l'Abbé J. J. de Smet, in his 'Histoire de Belge.' "The news of the arrival of the Spanish general caused the workshops to be everywhere deserted. Carrying with them their industry, thousands of artizans quitted their country, or enrolled themselves under the insurgent standard. Holland, France, but especially England, offered them an asylum; the provident Elizabeth did not confine her views merely to the relief of her religious partizans, but sought to

* On the Trade of India.

transfer into her kingdom those prosperous trades of the Low Countries, which the adjoining states had looked upon with invidious eyes. She succeeded beyond her most sanguine hopes, and thus eventually procured, with the aid of Belgian exiles, manufacturing pre-eminence to her country."

Lewis Roberts, who published in 1641 a little treatise on trade, called the 'Treasure of Traffic,' says, "The town of Manchester buys the linen yarn of the Irish in great quantity, and, weaving it, returns the same again in linen into Ireland to sell. Neither does her industry rest here, for they buy cotton wool in London that comes from Cyprus and Smyrna, and work the same into fustians, vermillions, and dimities, which they return to London, where they are sold; and from thence not seldom are sent into such foreign parts where the first materials may be more easily had for that manufacture." This fact of returning the manufactured article from England to the native country of the raw material, which attracted the attention of Roberts in one case, has become in our times a general feature of British trade.

It would, however, appear, that long before the date of the 'Treasure of Traffic,' cotton fabrics must have been commonly wrought in this island, for we find a sumptuary Scotch law, enacted by King James in 1621, directing "that servants shall have no silk on their cloths, except buttons and garters, and shall wear only cloth, *fustians*, and canvas of Scotch manufacture." It is possible indeed that the name fustian, from its Spanish import of *substance*, may be here given to some kind of substantial mixed stuff, different from the cotton fustian of Guicciardini.

Considerable obscurity is occasioned by the different meanings attached to the word cotton in English works about a century and a half or two centuries ago. It seems to have been corruptly used for coating, and denoted a species of woollen stuffs made for that purpose. Thus Leland, in his itinerary, written so far back as Henry VIII., says, that "Bolton-upon-Moor market standeth most by *cottons;* divers villages in the moors about Bolton do make cottons." The sense of this passage is cleared up by the terms of an act subsequently passed, in 1552, under Edward VI., for regulating the manufacture of *woollen* cloth, in which it is stated, "that all the cottons, called Manchester, Lancashire, and Cheshire cottons, full wrought to the sale, shall be in length twenty-two yards, and contain in breadth three-quarters of a yard in the water, and shall weigh thirty pounds in the piece at the least." Camden also may be quoted to prove the woollen texture of the cottons of those days; for he says "that Manchester excels the towns immediately around it, in handsomeness, populousness, *woollen manufactures*, market-place, church and college, but did much more excel them in the last age, as well by the glory of its *woollen* cloths, which they call Manchester *cottons*, as by the privilege of sanctuary, which the authority of parliament, under Henry VIII., transferred to Chester." From an act passed in the reign of Elizabeth, in 1566, we find that a certain quality of goods at Shrewsbury bore the name of "Welsh cottons, frizes, and plains;" language applicable only to woollen fabrics. Nay, at the present day a strange solecism remains in the language of Cumberland, where a peculiar woollen article of the

so much are they endowed with exquisite sensibility and pliancy in every organ and limb. The hand of an Indian cook-maid is more delicately formed than that of an European beauty. An English workman could scarcely manage to work a piece of canvass with the simple loom with which the Gentoo weaves his gossamer muslin. His calling receives encouragement from public estimation. A weaver is there no ignoble caste, upon which patrician Hindoos can look down with disdain. He takes rank next to the scribe, and above all other mechanics. Were he to condescend to the performance of any drudgery out of the line of his business, he would lose his caste. This distribution of labour is of very ancient date. Every peculiar kind of cloth is the production of a peculiar district, in which it has been fabricated from generation to generation by certain races of men, each continuing to practise with minute precision the process of his predecessor. Thus it was their fine physical organization, guided by hereditary industry and experience, which, as we have already stated, gave to Hindostan the monopoly of the cotton trade for at least three thousand years.

Of this extraordinary delicacy of tact, Orme gives the following example in describing the silk manufactures of Bengal. "The women wind off the raw silk from the pod of the worm; a single pod of raw silk is divided into twenty different degrees of fineness; and so exquisite is the feeling of these women, that while the thread is running through their fingers so swiftly that their eye can be of no assistance, they will break it off exactly as the assortments change, at once, from the first to the twentieth, from the nineteenth to the second."

Concerning the fineness of Indian fabrics, many surprising stories are told. The Emperor Aurungzebe who flourished at the commencement of the last century, on perceiving his daughter arrayed in a semi-transparent tissue, reproached her with its indecency; she defended herself by assuring him, that her robe was wrapped nine times round her body. Tavernier relates, that a Persian ambassador, on his return from India, presented his king with a cocoa-nut, which contained a muslin turban, thirty yards long, and which when expanded in the air could hardly be felt. Some of their broad webs of muslin may be drawn through a wedding-ring.

The quantity of cotton goods manufactured in India must have been exceedingly great, though no accurate statistical accounts of them are given. Within the Madras presidency not very long ago, there were eleven active factories or emporia of cotton goods, which produced to the value of a million sterling. But this sunshine of Hindoo trade has been for many years in a declining state, and can never be expected to revive under the competition of goods produced by British machinery. From the year 1821, when the first notable importation of English cotton twist into India took place, the speedy decline of its cotton manufactures might be predicted. Since then, the throstle and mule jenny, the two great arms of the Manchester Briareus, have been making frightful havock among Asiatic industry, depriving its myriads of spinners of their only resource,—dexterity at the distaff. Thus mankind, by the avariciously directed arts of peace, may come to prey on one another with as fatal an influence as by the arts of war. Prior to the above

period, however, the muslin and long cloth of Great Britain, had, in no small degree, supplanted the perkals and calicoes of Hindostan in the markets of the world. This fact will appear astonishing, if we compare merely the price of labour in India and England. The *retees* or the weavers' elderly wives, who are the most dexterous of hand-spinners, earn only three farthings a-day in producing the finest yarn, worth at one time from £3 to £4 sterling a pound, which is more than thirty times the price of the raw material; whereas the Manchester spinner with his machine can afford to make his fine yarn for one half the cost of its labour in India. Reckoning the mean price of fine cotton-wool in Great Britain at 2*s*. 6*d*., and in India at 5*d*., the cost of our labour and materials united would be considerably less than one half. Thus for example, the fine yarn of 250 hanks to a pound, costs, by Mr. Kennedy's statement, 35*s*. per pound in England, of which 4*s*. are allowed for material and waste, and 31*s*. for labour; and a pound of similarly fine yarn costs in India 84*s*., of which only 8*d*. can be charged for material and waste, leaving 83*s*. 4*d*. for the cost of spinning, which at the rate of even 2*d*. wages per day, is equivalent to 500 days, or to a period of nearly one year and a half of constant occupation! Such is the marvellous superiority of the iron fingers of Arkwright and Crompton over the limber and dexterous hands of the Hindoos. In this estimate, a spindle, whether moved by hand or power, is supposed to spin half a hank of yarn daily; equal to nearly one quarter of a mile in length.

The Indian yarn of the finest quality, such as exists in the celebrated Dacca muslin, transparent as the

woven wind, is very irregularly twisted, and appears in the microscope like an ill-made hair-rope bristling with loose strands. The fibres obviously belong to ill-cultivated *gossypium herbaceum*, and are mostly riband shaped. The transparency of the web arises from the transparency retained by these riband filaments in their separate state; for if they were twisted more closely they would form a nearly opaque yarn, like the British. The filaments vary in diameter from $\frac{1}{1000}$ to $\frac{1}{1500}$ of an inch, and are therefore much coarser than those of Sea-Island cotton. Some of the yarns in the web consist of six filaments, others of seven, eight, and more; so that they possess little uniformity. A piece of fine British book-muslin, viewed by the same magnifying power, presents a very different aspect. The yarns are regular cords, most equably twisted, without any bristling ends; and consist of cylindric filaments, very faintly translucent. On viewing the fine Indian yarn, it is easy to comprehend how the looseness of its cohesion should require the web to be woven upon some occasions under water, in order to give it support, as the anatomist developes filmy textures while afloat in the same medium.

The cotton when spun is delivered to the winders, who are frequently the younger wives or girls. The winding machine consists of three parallel bars of wood laid flat on the ground, and kept in their places by a cross piece. From the upper surface of the bars pegs stand up, round which the yarn is wound from the bobbins in a horizontal direction. The coarser yarn is used for the chain or warp of the web, the finer for the woof. The former is prepared for the weaver by boiling in hot water, and then plunging it into cold;

but the woof, being usually less coherent, is strengthened by the gluten of cow-dung; for it is first soaked in water mixed with a little of that substance, then wrung out, laid in a covered vessel for some days to become uniform, and lastly dried in the sun.

The next process is the warping. The machine used for this purpose consists of a straight range of bamboo sticks about three feet long, stuck on end in the ground, two feet apart. Young persons are taught to run nimbly with the bobbins in their hands along that range, interlacing the yarn round each stick upon alternate sides, and applying it uniformly by means of a guide composed of a bamboo having a ring fastened to its point. When the warping is finished, additional sticks are inserted between the others to keep the yarns in their position; after which the whole is rolled up with the bamboos, immersed in a tank of water for a short time, and trodden with the feet to ensure its thorough saturation. It is next taken out, dried, remounted by fixing the bamboo sticks once more in the ground, and carefully examined by the weaver to see what threads are broken that he may mend them. The sticks being now withdrawn, the warp is laid along trestles about a yard high, placed at regular distances, and is rubbed over with rice water of a mucilaginous nature, kept till it has become sour. This corresponds to the weaver's dressing in Europe. The chain of yarn must now be carefully arranged, first with the fingers and then with a whisk of slender twigs, in order to place the threads truly parallel, as well as to smooth and clean them. Lastly a mucilage of boiled rice is spread over the warp to stiffen it, and when dry it is

softened by rubbing it with oil. It is now ready for the loom.

This process was deemed so important as to be regulated by ancient statute. "Let a weaver who has received ten patas* of cotton thread give them back increased to eleven by the rice water, and the like used in weaving; he who does otherwise shall pay a fine of twelve panas."—(*Institutes of Hindoo Law*, chap. viii. sec. 397, *by Sir William Jones*.)

The *tanty*, or Hindoo weaver, digs first a hole in the earth for his legs, so as to be conveniently seated on the ground. He then drives two strong bamboo stakes into the earth at a distance apart proportional to the breadth of his web, and near enough to a wall or a tree for fixing the stakes to it by slender bamboos The Engraving (*see fig.* 1, *page* 33) represents the primitive oriental loom. It consists merely of two roller beams resting on two pairs of stakes driven into the ground, and two sticks which cross the chain or warp, and which are supported at each end, the one of them by two cords tied to the palm tree, under whose shade the loom is placed, and the other of them by two cords fastened to the foot of the weaver. These enable him to part the alternate yarns, for the purpose of traversing the warp with the woof. A very rude stick or wooden bar serves the weaver for a shuttle, which answers also the purpose of a batten for driving home each woof yarn against its predecessor, so as to give the cloth the proper closeness of texture. The loops beneath the geer, into which he inserts his great toes, serve him for treddles, and with his long shuttle he both draws the weft through the warp, and closes it up. With such

awkward mechanism as this, are woven those muslins of aerial fineness, transparent and delicate as the gossamer web. The reed is indeed like our own, and is the only thing made with the appearance of mechanical skill.

The destruction of the Mahometan dynasty in Hindostan gave a deadly blow to the manufactures of Dacca, the beautiful fabrics of which were bought principally for the court dresses of the emperor and his omrahs. The *perkals,* so called from a Tamul word signifying superfine, were made in the Carnatic of a silky cotton grown in the plain of Arcot. The district of Condover furnishes the showy handkerchiefs of Masulipatam. Chintzes are produced chiefly in the Calcutta and Benares districts, and in the Masulipatam district of the Circars.

From the division of labour between Mahometan and Hindoo workpeople, we have already shown that the cotton trade of India has not continued stationary since the institution of castes, but received certain modifications along with the Arabian dynasty. Mr. Richards indeed stated in the parliamentary discussion of 1814, upon the renewal of the East India Company's charter, that the distinction of castes, which assigns to the son of a Hindoo the trade of his father, is now *maintained chiefly by the* pressure of fiscal exactions, and the abject poverty of the people. In Calcutta and Bombay the Hindoo population have emancipated themselves very much from their ancient trammels, and have displayed equal energy and intelligence in commercial transactions. The time is probably not far distant when the benefits of knowledge and the

blessings of religion will be largely imparted to that gentle race, and enable them to take a more important share in the arts of civilized life. Hitherto the cotton trade has done no more for their dignity and comfort than the manufactures did for the slaves of the Roman grandees. Both laboured for hard task-masters in a huckster-like way, and received the scantiest livelihood in return. No motive was presented to their minds to improve their respective processes, and to multiply their productive powers; for the fruit of any such improvements would not have been reaped by them. What a contrast in this point of view is afforded by the arts of Great Britain and those of India! None of the oriental rajahs, however favoured with opulence and tranquillity, ever appear to have proposed the introduction of better implements, or the association of scattered workpeople into a manufactory. However reputable the profession of the Tanty in the scale of castes, it seems never to have been lucrative enough to procure for him or his descendants sufficient capital for the commercial part of his business.

While the East India Company made their remittances to Europe in cotton goods, they were obliged to advance, through their residents at the different stations, not only the cotton wool, but the funds requisite to support the workman and his family during the progress of the manufacture. Under this officer, as chief, a corps of European servants was placed, who watched over and directed the native clerks and *peons*, or immediate superintendents of the weavers; the resident sent forth his proposals for certain quantities of goods to the native merchants, who treated in their

turn with the workpeople. As soon as the terms were agreed upon, the resident advanced the funds to the contractors, who distributed them at his discretion, and became responsible for the delivery of the manufactures at the Company's stores, according to stipulation. The Company's resident never interfered with the contractors in their details, unless complaints were made of fraud, delay, or the interference of contractors acting in other interests; in this case peons were dispatched to intimidate, and if necessary to coerce, the weaver. When the weavers had no engagement for the Company, the resident had the privilege of employing them on his own account; he became hereby a person of great importance to the people, and was regarded by them as the chief source of their subsistence, and the main-spring of their industry; hence, although the native brokers who acted as contractors for the Portuguese and other traders did offer a higher price for the goods than the British resident had fixed, the weavers, however strongly tempted to evade his orders or to smuggle away their cloth, never durst openly dispute his commands.

They were taught to consider the commercial resident as a man of authority, and not as a mere merchant; he dwelt in a palace, and was surrounded by all the pomp and circumstance of high station, the moral effect of which is well known to all who have been in India. Correct, too, and honourable as he himself may have been, the details of his duties mainly devolved on sircars and other subordinate employés spread over the district, with much real and more assumed power, and more or less corrupt from the

inadequacy of their salaries in comparison with their means of extortion and tyranny. Some light is thrown on the compulsory tendency of the Company's commercial system by the 8th paragraph of the Board's letter, dated 27th April, 1827, which is as follows: "It will therefore be your duty to explain these matters fully to the peons and rearers of cocoons employed under your factory, *so as to prepare their minds to submit without murmuring to the prices you may deem it necessary under these orders to determine on granting them for the silk and cocoons produced during the several bunds of the year, impressing it at the same time upon them, as a matter of absolute necessity, that they will seek in vain to elude the operation of the system now about to be established, by carrying their cocoons away from their own factory in order to deliver them into a neighbouring factory for the sake of obtaining increased prices, because by so doing they will inevitably meet with disappointment.*"*

Such unlimited influence over a simple people in a remote district no doubt led to frequent acts of injustice. Various laws and regulations were enacted to protect the weavers against oppression, but it is believed with little effect, for the sovereign power which ought to have administered impartial laws was, in fact, the avaricious and needy trader, whose interest it was to be unjust. Now that the India Company has ceased to be traders, they will have no motive to harass the Tantys through the medium of resident contractors, but will leave them at full liberty to bring their indus-

* Mr. Brucken—Appendix to Report on E. I. C. Affairs, p. 521.

try to the best market. In such circumstances the Indian artisan will find his condition vastly improved; he will be persuaded to employ his dexterity under more liberal auspices, and will be furnished with better implements to sustain the competition against European rivalry. A style of goods may thus be produced surpassing in beauty anything ever manufactured for the court of the Grand Mogul. It is not probable that the Hindoo will submit to the irksome confinement of a factory, but with a better cotton yarn and better loom he may be able to fabricate his peculiar light muslins at so cheap a rate as to make head in some measure against the overwhelming resources of Europe. The late attempt to erect a cotton factory at Calcutta seems to have been injudicious, and failed; a second company have indeed resumed the scheme, but they can hope for little more success; they had, some time since, nearly 700 persons employed in their spinning-mill at the rate of 7*s.* each in the month; but they found these native workmen incapable of sticking to their task more than a few hours at a time, and they require, therefore, two or more relays of hands in a day. Such individuals can never become proficient spinners, nor even at the low rate of wages can they furnish yarn fit to cope in the market with the production of Lancashire; it is only by giving every encouragement to their exquisitely fine faculties and endowments that they can be expected to become profitable servants to an enterprizing manufacturer. Instead of being under the necessity, as at present, of taking down their loom every evening and erecting it every morning, or stopping their labours every rainy day, they should be provided with covered galleries

open at the sides as warping and weaving shops, in which the work could go on uninterruptedly upon the plan of alternate labour, to which they have been long familiar; they should also be provided with the means of better cotton-husbandry by the introduction of a better cotton-seed, a better system of agriculture, and a better gin for cleaning the wool. Thus seconded in a kindly spirit, the Hindoo artisan might once more delight the luxurious with webs of incomparable elegance, at such a price as would ensure for them an extensive and ready sale. Yarn continues to be spun and muslins to be manufactured at Dacca, to which European ingenuity can afford no parallel; such, indeed, as has led a competent judge to say it is beyond his conception how this yarn, greatly finer than the highest number made in England, can be spun by the distaff and spindle, or woven afterwards by ANY machinery.

It is in spinning the more tenacious warp-yarn that machinery has the greatest advantage over the hand, and accordingly it was that description called twist which first made its way from this country into India. In 1815 the small quantity of eight pounds was sent out on trial, and in the same year the importation of British white and printed cotton goods into India amounted to nearly 800,000 yards, the whole of which was probably purchased by our countrymen; but in 1830 the quantity of British cloth imported into India had increased to 45,000,000 yards, indicating a prodigious extension of sale all over the Peninsula, even among the natives, to the exclusion of their own fabrics, which could not be afforded at so moderate a price. In the preceding year, 1829, no less than 3,185,639

pounds of cotton twist had been introduced into India. From the extent of these importations some idea may be formed of the vast field for the cotton trade which exists in Southern Asia. The Tantys must have taken very readily to the weaving of British wares, for in 1824 only 121,000 pounds were introduced for their looms, while five years thereafter they consumed twenty-five times the quantity. This rapid extension of commercial intercourse from England to India was owing entirely to the spirit of private merchants; the Company were as remiss in this respect as they have always been in ameliorating the culture of cotton.

The average price of the twist imported into India in 1829 was 1*s.* 3¾*d.* per pound. In the year 1834 4,267,653 pounds of cotton twist and yarn were imported from Great Britain into the East India Company's territories and Ceylon, of which the total declared value was £315,583, being at the rate of 1*s.* 5¾*d.* per pound. The greatest importation, however, took place in 1831, when it amounted to 6,624,823 pounds in weight, and to £467,861 in value. In 1834 about 40,000,000 yards of cotton cloth were imported into India.

For a view of the quantities of cotton twist and yarn imported into other countries in these years, see the Statistical Table at the end of the third volume.

BOOK II.

NATURAL HISTORY AND HUSBANDRY OF COTTON.

CHAPTER I.

Natural History.

THE filamentous down which invests the seeds of the *gossypium*, a plant of the natural order malvaceæ or mallows, is the substance called in English commerce cotton-wool, and in French *coton en laine*, from its resemblance to the fibrous fleece of the sheep. It is usually white, of various shades of purity; but it is sometimes cream-coloured, and at others iron-yellow or tawny. The filaments, when viewed in a good achromatic microscope, appear to be for the most part riband-formed or flattened cylinders, with a thickened list at either edge, and veins of embroidery running along the middle. They vary in length from half an inch to one inch and three-quarters; and in breadth from $\frac{1}{700}$ to $\frac{1}{2500}$ of an inch, tapering always to a fine point at their ends. These variations in length and breadth belong to plants of different growths and countries, the filaments being pretty uniform in the average product of each particular crop. The lustre of cotton, as seen in the microscope, is pearly, whereas that of flax is vitreous. Whether a cylinder or a riband, the cotton fibre is seldom or never straight like that of flax, but is either twisted right and left or coiled like a cork-screw. Those of the best Sea

Island, the most valuable species of cotton, very commonly appear to be beautiful spiral springs, singularly adapted to the spinning process, readily entwining with, and sliding over, each other, during the formation of a thread, with an easy elastic force. There are no feathery margins, as some writers have described.

The word cotton may be traced most clearly to the language of Arabia, a country where the plant is indigenous, where it was probably applied to clothing purposes in the infancy of the human race, and whence, undoubtedly, it was brought into Western Europe at the era of the Mahometan conquest. The textile down is called in Arabia gotn or gootn, which signifies also soft; a word evidently identical with the Spanish godon, or algodon, formed like alkali and alkohol of the prefix article al, and the noun. Skinner's derivation from *cydonium*, the quince, from its near resemblance to the down which adheres to that kind of apple is unworthy of criticism. *Cotonea* and *cydonea* are two words equally applied by Pliny to the quince. The following names have been given to cotton in different languages:

Greek . .	Bombyx, Xylon.
Latin . .	Gossypium, Bombax.
Italian . .	Cotone, Bombagia.
Georgian . .	Bomby, Bamba.
India . .	Kopa, whence the English term *cop* for a pirn of cotton yarn.
French . .	Cotonnier for the plant, Coton for the wool.
German . .	Kattunwolle, Baumwolle.
Dutch . .	Kétoen, Boomwol.
Danish . .	Bomold.
Swedish . .	Bomull
Spanish . .	Algodon.
Portuguese .	Algodâno, Algodeiro.
Russian . .	Bomaga, Chloptscha taja.

Mongul . . Kobung.
Chinese . . Cay-Haung, Hoa-Mien.

Gossypium or cotton constitutes a perfectly natural family of plants, in which the specific differences are remarkably slight. Since the filamentous down, which invests the seeds, differs exceedingly in quality and value in different varieties of the plant, corresponding botanical distinctions have been sought after with great assiduity, but hitherto with very little success. Indeed, M. Decandolle, one of the most eminent botanists of the age, confesses that the family gossypium stands much in need of more minute investigation. The botanical characters have been taken from the leaves, the stipules, the glands, the spots, the colour, the hairs on the stem, and the durability of the plant. The leaves are subject to great variations in the form of their subdivisions or lobes, not merely in the same species, but in the same individual shrub. On one stem may be found two or three very different forms of foliage, resulting from soil, climate, and cultivation. Glands have been noted as distinctive of peculiar species, but they may be found in all the gossypiums; nay, on the same shrub, some leaves may be observed having only one gland, and others with two or even three glands. The stipules are generally uniform in shape and direction. The colour, the spots, and the hairiness of the stems or branches, are too variable to form subjects of specific distinction. Nor is the durability of the plant constant in the same species. The shrub cultivated as an annual at Malta, under the incorrect title of gossypium herbaceum, may under certain circumstances last for several years. Thus the cotton growers at Motril in Spain raised

N. B. All the species are uncertain, being founded on precarious characters. In enumerating the species recognised by botanists, Decandolle intimates that the genus is greatly in want of an accurate monography drawn up from the life.

1. G. HERBACEUM (*Linn. Sp.* 975).—Leaves five-lobed with one gland beneath; lobes round with a point; the outer calyx serrated; stem smooth; annual, biennial, or perennial, according to situation and circumstance; petals yellow, with their bases spotted with purple.

2. G. INDICUM.—Leaves obtuse, three to five-lobed; no glands beneath the outer calyx; slightly notched at the point; stem hairy, annual or biennial; in the East Indies; flowers yellow, with purple claws.

3. G. MICRANTHUM.—Leaves obtuse, five-lobed, very smooth; one gland beneath; outer calyx many cleft, longer than the pe[illegible] stem smooth and dotted; in Persia and Ispahan

4. G. ARBOREUM. — [illegible]nate, five-lobed, lobes obtusely [illegible]anceolate, pointed with a short bristle; one gland beneath; outer calyx pretty entire; perennial in the sandy soils of India.

5. G. VITIFOLIUM.—Lower leaves palmate, five-lobed; upper ones three-lobed; one gland beneath; outer calyx fringed; inner calyx three glands at the base; stem smooth and dotted; in the East Indies.

6. G. HIRSUTUM.—Upper leaves undivided and heart shaped; lower three to five-lobed, with one gland beneath; the small branches and the petioles hairy; outer calyx three-toothed at the apex; in South America; flowers yellow, perennial.

7. G. Eglandulosum.—Leaves five-lobed, without glands; three of the lobes oblong acuminated; stem woolly; outer calyx three to four-toothed at the apex.

8. G. Religiosum.—Upper leaves, three-lobed; lower five-lobed, one gland beneath; branches and petioles with black dots; outer calyx with three leaflets fringed downy; the wool of the seeds of a pale saffron colour; in the East Indies.

9. G. Latifolium.—Leaves acute, lowest undivided, the rest three-lobed; one gland beneath.

10. G. Barbadense.—Upper leaves three-lobed; lower five-lobed, three glands beneath; stem smooth; seeds free; in Barbadoes.

11. G. Peruvianum.—Leaves five-lobed; three glands; lower leaves undivided; outer calyx fringed; three glands at the base; in Peru; flowers yellow with purple claws.

12. G. Purpurascens.—Leaves three-lobed, downy beneath; ovato-lanceolate acute; outer calyx fringed; branches somewhat downy at the end; capsule three-valved; in South America.

13.—G. Racemosum. Very smooth, leaves sub-cordate three-lobed acuminate; flowers at the ends of the branches somewhat spreading; outer calyx fringed; capsule three-valved; in Porto-Rico.

Species to be examined:—

G. Obtusifolium.

G. Acuminatum.

G. Glandulosum.*

The following details are from other botanists:—

* Decandolle, Prodromus.

visit in 1566 to Hyeres, the orator takes occasion to boast of the oranges, palms, and cotton plants, which were raised in the fields round that town. The same fact is attested by the bishop of Senez in a curious work on agriculture published in 1606, in which he enumerates sugar canes, cinnamon, and cotton, as productions of Provence. Bauhin, the botanist, likewise states that the cotton plant was grown in France, having been introduced from Italy. It is curious to remark how entirely this species of agriculture fell into disuse, and was forgotten.

2. *Gossypium Barbadense.*—This species is supposed to be a native of the American continent. It is a shrub five or six feet high. Its stems and its branches are smooth, and the leaves have a polished surface. The lower leaves have five lobes, the upper ones three. These are entire, acute, and have three glands on their back surfaces. The flowers, which are very large, have a deep yellow colour. The capsule is also large and produces a large body of cotton. The seeds are black. When triturated with water they afford a milky emulsion which is used medicinally at Cayenne. This is the species in most general cultivation in the West India islands.

3. *Gossypium Indicum.*—This species forms a shrub from ten to twelve feet high, having its branches covered with a down, somewhat woolly towards their tops. The leaves are of a moderate size, have three short oval lobes without glands, and are frequently variegated beneath with small black spots. The petioles and veins are velvety; the flowers are large with short peduncles; the petals are yellowish, and marked at their base with a brown-purple spot. The

capsules are oval, sharp-pointed, three-celled, and open with three or four valves. They contain blackish seeds, wrapped up in very white cotton wool. This plant grows spontaneously in moist situations in the East Indies, and is also cultivated in that quarter of the globe. Some remarks of Linneus on the Gossypium Herbaceum belong more properly to this species, which rises sometimes to the height of fifteen feet, and is on other occasions only three feet high.

4. *Gossypium Arboreum.*—This species is the tree-cotton; it rises sometimes, in favourable situations, to the height of fifteen or twenty feet. It is a native of India, Egypt, and Arabia. It is well characterized by its brownish-red flowers, by the hairiness or bristliness of its upper branches, by its palmate leaves with fine lance-shaped, digitate lobes, and by a gland on the posterior veins. The peduncles are short, solitary, one-flowered; the leaflets of the outer calyx are entire, or three-toothed; the capsules are ovate, sharp-pointed, have three or four valves, as many seeds in each cell, and are enveloped in an abundant cotton wool, white and excellent. It is reckoned the finest of the Indian varieties of cotton, particularly on account of its flexibility and whiteness.

5. *Gossypium Vitifolium.*—The vine-leaved species. It grows in the Isle of France, in the Celebes, in India, and was at one time much cultivated in St. Domingo. Its branches are nearly free from down, but they are studded like the leaf-stalks with tuberculous points; the leaves are large, palmate, and cut down into fine lobes. The flowers are large, yellowish, and spotted with purple at their base. In St. Domingo this species was triennial, and had black seeds when it was grown

in a propitious soil near the sea shore. It attained to the height of twelve or fourteen feet. When the plant grows in a soil unfavourable for its perfect development, the seeds are greenish, the cotton staple is coarser, and is difficult to separate from the seeds. The seeds are egg-shaped, and are from six to eight in each cell. Capsule three-celled.

This species differs from the next in the number of glands on its leaves and calyx. The vitifolium has six glands on its calyx, and only one on its leaf. Its leaf-lobes divaricate more than those of the Peruvianum.

6. *Gossypium Peruvianum.*—The cotton plant of Peru is a shrub three feet high. Its leaves are large, heart-shaped, downy, and furnished with three glands. The lower leaves are entire, oval, acute; the upper leaves have five acuminated lobes. The inner surface of the flower-cup is besprinkled with blackish points. The corolla is large, yellow, somewhat velvety, and reddish-coloured at the base; the capsules are ovate, acuminated, and three-valved. The seeds are blackish, and wrapped in a long-stapled, white wool. There are three glands in the calyx. The capsule is three-celled, and contains in each cell many seeds.

7. *Gossypium Hirsutum.*—This species was discovered in the hot regions of America. Its stem rises to the height of two or three feet, and then divaricates into boughs, which bristle with hairs. The leaves are also hairy on their inferior surfaces, and are three or five-lobed. The upper leaves are entire and heart-shaped; the petioles are velvety. The flowers near the extremities of the boughs are large, and somewhat dingy in colour. The capsules are ovate, four-celled,

nearly as large as an apple, and yield a very fine silky cotton wool, much esteemed in commerce. The seeds are greenish.

8. *Gossypium Tricuspidatum.* The three-pointed cotton plant. This is an Indian shrub, three or four feet in height, with spreading branches, somewhat velvety towards their summits, and covered, as well as the petioles, with small black dots. The flowers are white, with sometimes a sulphur tinge, or a rose or purple hue, on the edges. The capsules are short, acuminated, and contain a soft white cotton which adheres very firmly to the seeds.

9. *Gossypium Micranthum.*—The small-flowered cotton plant. Its stems are reddish, about a foot and a half high, smooth, and besprinked with blackish dots, which are also found on the petioles and peduncles. The leaves have five very obtuse lobes, and a gland above their base. The outer calyx has three deep divisions, fringed, and longer than the corolla; the inner calyx is shorter, and five-toothed. The petals are yellow, oval, acute, marked with purple at their base, and a little velvety above. This plant is a native of Persia. It was cultivated in the Jardin des Plantes at Paris under the name of Gossypium Purpurascens, and was brought thither from the Antilles.

10. *Gossypium Religiosum.*—The cotton of the Nuns. In this species it is extremely difficult to pick the wool from the seeds, the filaments being so short, and so closely condensed, as to be inseparable by rollers. Hence the nuns at Tranquebar were employed to pick the wool from the capsules. One pound of Tranquebar cotton employs a woman thirty hours to separate; and a pound of Cambaye cotton,

twenty-six hours. Three quarters of an ounce of cleaned cotton is the total product of a shrub three feet high. This plant is a native of the Cape of Good Hope, and has been cultivated in the Jardin des Plantes under the name of the White Cotton of Rome. This species is distinguished from the others by the protrusion of its long style before the expansion of the flower, and by the spotless whiteness of its blossoms, which changes into red. The yellow Cotton Plant of Siam, grown in the Jardin des Plantes, resembled the Religiosum in every thing except the colour of its wool, which was nankeen.

Roxburgh gives the following descriptions :—

Gossypium Herbaceum (*Roxburgh*).—Bi-triennial, young parts hairy; leaves hairy, palmate, with sub-lanceolate acute lobes; *leaflets* of the exterior calyx dentate; capsules ovate, pointed, seeds distinct, clothed with firmly adhering white down under the long white wool; kootn of the Arabians, karri-kapass of the Bengalese. "This," says Dr. Roxburgh, "and its varieties are by far the most universally cultivated by the natives of India."

Trunk short, nearly straight, woody, often lasting three or even four years; bark ash-coloured or brown, and by age becomes cracked in various directions; branches numerous, with their tender extremities well clothed with long, soft, diverging hairs, and marked with numerous rust-coloured dots; general height, when cultivated on a middling soil, about three feet, though in a rich garden loam they rise to eight or even ten feet; leaves alternate petioled, hairy on both sides, palmate; lobes from three to five, in young plants

lanceolate, in old almost ovate; size very various; colour pale green; *glands;* in large luxuriant leaves there is generally a single one near the base of each of the three middle or large nerves; but Dr. R. does not think they can ever be so much depended on as to form a part of the specific character in this or any other of the species. *Petioles* hairy, nearly as long as the leaves; *stipules* obliquely linear, lanceolate; *peduncles* solitary, short, hairy opposite to the leaves, or on one side of them; *flowers* solitary, large, pale yellow, with the bottom of the bell of a dark crimson colour; *calyx exterior*, leaflets sometimes nearly entire, sometimes acutely dentate, or even gashed, hairy, with a gland on the base of each; *inner* obscurely five-toothed; *corol* large, campanulate; *stamens* numerous; *stigma* clavate, three or four-ribbed, and spiral; *capsule* ovate, pointed, three or four-celled: seeds a few in each cell, distinct, clothed with much firmly adhering whitish-grey down under the long white wool or cotton.

Of this species there are an infinite number of varieties from soil, situation, method of culture, &c. I shall make a few remarks on as many of these as I have been able to rear under my own eye.

I. *Dacca cotton.*—This sort may be reckoned the first variety, or deviation, from the common herbaceum, in general cultivation over Bengal and Coromandel; it is reared about Dacca in Bengal, and furnishes that exceeding fine cotton wool employed in manufacturing the very delicate muslins of that country. It differs from the common in the following respects:—1, in the plant being more erect, with fewer branches, and the lobes of the leaves more pointed; 2, in the whole plant being tinged of a red-

dish colour, even the petioles and nerves of the leaves, and being less pubescent; 3, in having the peduncles, which support the flowers, longer, and the exterior margins of the petals tinged with red; 4, in the staple of the cotton being longer, much finer, and softer.

These are the most obvious disagreements, but whether they will prove permanent Dr. R. could not say.

II. The *Berar cotton,* with which the fine Madras long-cloth is made. It differs from the above two sorts; 1, in growing to a greater size, in living longer, in having smoother and straighter branches; 2, in having the leaflets of the exterior calyx more deeply divided, and the wool of a firmer and more durable quality.

III. *China cotton.*—Its wool is reckoned 25 per cent. better than that of Surat. It differs from the former sorts; 1, in being infinitely smaller, with but very few short weak branches; 2, in being annual; 3, in having the leaflets of the exterior calyx entire or nearly so.

Gossypium rubicundum (*Roxburgh*)—is found in the gardens of the curious over most parts of India, where it is in flower great part of the year. Dr. Roxburgh does not believe it to be ever cultivated for its wool.

Gossypium Barbadense (*Roxburgh*).—Shrubby; leaves smooth, with five acute short broad lobes; leaflets of the exterior calyx deeply laciniate; colour of the corolla uniformly yellow; capsules oblong, pointed; seeds distinct, black, and without any other pubescence than the long white cotton wool.

Bourbon cotton is the name this species is known by

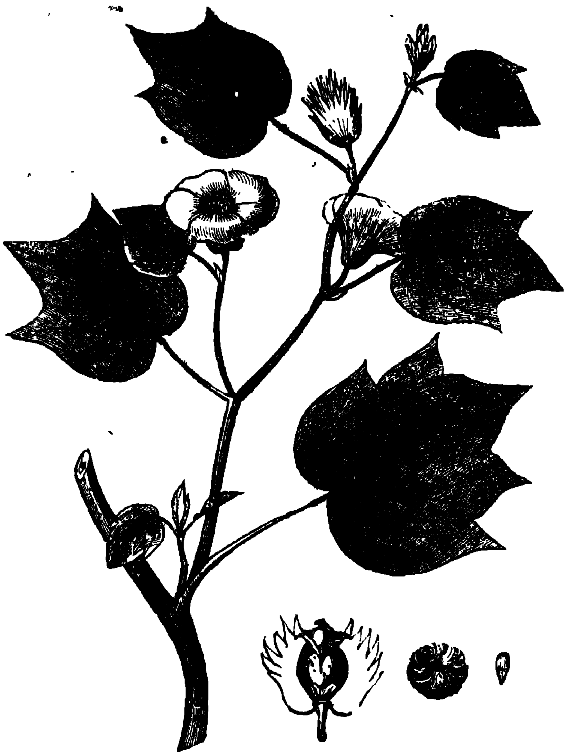

Fig. 5—Gossypium Barbadenses.
Copied from a drawing by Dr. Roxburgh, in the Library of the East India House.

amongst the English in the East Indies. It does not appear to be a native of India, but was introduced from the Island of Bourbon some twenty years ago; at what period it was brought from the West Indies into that island is uncertain; it succeeds better in the more elevated, drier, and less fertile soil of Coromandel than in Bengal, where the plant grows to a greater size, but yields less cotton. Stem short, ligneous; in a good soil grows to a foot or more in circumference; branches

numerous, spreading in every direction; well grown plants rise to from eight to twelve feet, and spread nearly as much; bark of the woody parts ash-coloured.

Such is a description of the species of gossypium, derived from the best sources of information.

M. Rohr, who made an extensive tour through the West Indies to establish distinctive characters, between the different cotton plants, subservient to the commercial supply of cotton wool, attempted to introduce a new arrangement of the species of gossypium founded on the appearances of the seeds. I shall give a brief outline of his scheme for the sake of certain practical points which he ascertained, though, viewed in a systematic light, it is altogether nugatory.

M. Rohr distributes the cotton plants grown in the West Indies into four groups:—1, the rough black seeded; 2, the dull-brown seeded, with smooth veiny surfaces; 3, seeds covered with short hairs, through which the colour of the coats may be seen, but the veins can hardly be perceived; 4, seeds more closely covered with thick hairs. Each of these grand divisions is subdivided by M. Rohr into several species, which he has denoted by vulgar or trivial names, quite independent of those assigned by the botanists; his characters can therefore be of little use on account of their vagueness, as also of the seeds changing their appearance with the soil and climate in which they are produced.

Group I.—*Cotton with rough black Seeds.*

To this group M. Rohr refers, 1. The wild or withy-wood cotton of our colonies. It rises nine feet high, and spreads out from six to eight feet. Each tree

produces at the utmost only one quarter ounce of cleaned cotton. 2. The green-tufted cotton, from the green colour of the down on the unripe capsules. The fine cotton of Martinique belongs to this group. The shrub is three feet high, and yields a crop of two ounces and a half, which is gathered successively during seven months, beginning in November. 3. The sorrel-green cotton plant, and the sorrel-red, both cultivated near Spanish town, afford, the former four ounces, and the latter seven and a half ounces of cotton wool. 4. One of this group has seeds with a barbed point. The shrub is seven feet high, and yields three ounces of cotton. 5. The cotton plant, having barb-hooked seeds, such as the red shanks of St. Thomas and Santa Cruz. It is six feet high, and yields five ounces in a favourable season. 6. The *jahr-rund*, or year-round cotton plant, so named because it affords a succession of ripe capsules at every season. It grows in Jamaica and St. Domingo, as also in Montserrat, where it is called the loaf cotton, because it carries a tuft round the point of the seed. It is a productive and durable species. It grows to the height of six feet, and yields seven ounces of an average crop. These are properly coarse *year-rounds*; the fine year-round belongs to *Porto-Rico*. 7. There is a cotton plant with large flocks, called in St. Thomas *Old Bess*. It grows to the height of eight feet, and yields four ounces of wool; but its delicacy has thrown it into discredit. 8. The *Guiana cotton*. The seeds adhere to each other in the cells, and assume the form of a long thin pyramid. Its wool is white and long stapled. It has a variety of names, as Cayenne, Surinam, Demerara, Berbice, and Essequibo. It yields

two crops every year, amounting together, in favourable weather, to a pound and a half; but, in rainy seasons, to only half a pound. In Jamaica it is called ridney and link cotton. Each plant occupies a space of ten or twelve feet when grown in a good soil. 9. *Brazil cotton.* The seeds of this kind strongly adhere to one another, so as to form a broad short pyramid. It is an excellent cotton shrub.

Group II. *Brown-black seeded Cotton-trees, smooth and veined.*

1. Indian cotton.—It produces twice a-year, and affords a very white cotton, which may stand long in the pods without being coloured by the rains. Its wool is finer than any of the preceding cottons, and may be easily cleaned. It occurs at St. Martha and Carthagena, in shrubs eight feet high, spreading to the extent of ten feet, and yields eight ounces. 2. The Siam cotton, with brown, smooth seeds; the *coton lisse* of Martin, as also the white and red or nankeen Siam, belong to this head. These shrubs attain the height of twelve feet the second year, and afford one crop annually, which is gathered from February till April. The capsules fall off as they ripen, and those which adhere open no more than half. The red yields only three or four ounces, and is not worth the cultivating; the white, however, yields double that quantity.

Group III. *Thinly-haired Seeds.*

The cotton shrub of Curaçoa.—The wool when well cleaned is very white and beautiful, and must be plucked from the seeds by hand. It is too costly for European commerce, and is therefore manufactured on

the spot into fine stockings. Each shrub, as usually grown, yields only an ounce and two drams of wool; but when it is planted at wider intervals each shrub yields seven ounces and two drams. The capsules go on ripening in succession from February to June, and the harvest is therefore very troublesome. The crowned-cotton of St. Domingo resembles the Indian in quality, and yields two annual crops.

Group IV. *Thickly-haired Seeds.*

Cotton of the Nuns.—Gossypium Religiosum.—The seed of this species is small, nearly globular, covered with a greyish-white down and some hairs, of which those round the point are much longer than the seed, and diverging, but few in number. Two varieties of this cotton are known; that of Tranquebar, with the lobes of the leaves pointed; and that of Cambaye, with the lobes rounded. Neither of them produces more than three quarters of an ounce of wool. The filaments are very short, condensed closely round the seed; not to be removed, therefore, by rollers, and very difficult to separate, even by the fingers. A pound of Tranquebar cotton takes a woman thirty hours to detach; and a pound of Cambaye cotton twenty-six hours. Such irksome and unprofitable labours were, therefore, devolved upon the nuns, whence the name *Cotonnier des Nonnes* was derived, as we have already said.

MICROSCOPIC EXAMINATION OF COTTON FILAMENTS.

The specimens were kindly furnished to me partly by Messrs. Trueman and Cook, the eminent brokers in London, and partly by Henry Houldsworth, Esq., of Manchester.

Sea-island.—Turnbull, 1833. Price 2*s*. 2*d*. per lb. This is one of the finest cottons; raised from good select seed. Average diameter $\frac{1}{2000}$ of an inch; many much smaller; distinct spiral character; some rather flimsy ribands; long staple, about 1½ inches.

H. Seabrook, 1833. A healthy good quality of cotton. Price 2*s*. 1*d*. Filaments less than $\frac{1}{2000}$ of an inch broad; very spiry and uniform flattened cylinders; almost no flimsy ribands, nor warts.

Eaton's, 1833. Short and coarse Sea-island; but healthy. Price 1*s*. 3½*d*. per lb. Very uniform spiry filaments; no ribands; diameter of flattened cylinders $\frac{1}{1900}$ of an inch.

E. 1833. Pretty fine but not very strong; 1*s*. 7*d*. per lb. Flattened cylinders of about $\frac{1}{2000}$, mixed with a great many flimsy ribands, some of them irregularly contorted; a few warts.

Wilson, 1829. Grown from select seed, and was of superior quality, but has deteriorated, apparently by keeping. Price 4*s*. 6*d*. in 1829. Fine uniform filaments rather less than $\frac{1}{2000}$ in diameter; spiry; seems crimped transversely with irregular bendings; the effect probably of age.

Burden's Growth, from select seed, sent over in 1826, and kept in a small quantity and in a dry place ever since. Its quality was superexcellent for making the highest numbered yarn, when first received in this country, both as to fineness and strength. It

Fig. 6.

Fig. 7.

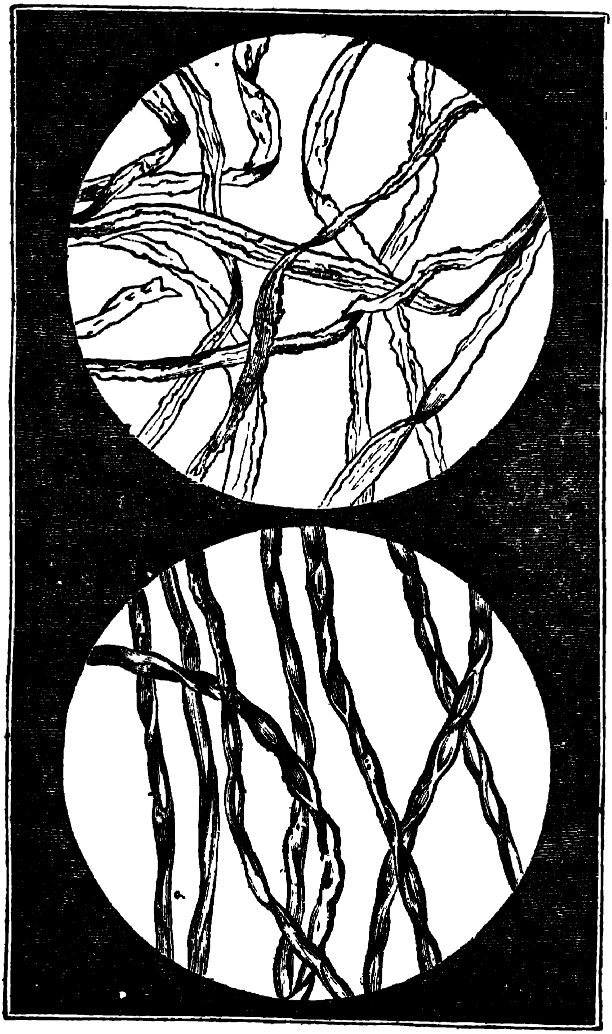

Fig. 6.—Sea-island Cotton, of which muslin and bobbinet lace are made.
Fig. 7.—Religious Cotton, threads of which are worn by the Brahmins round their necks.

cost 5*s*. per lb. It has evidently deteriorated by keeping; filaments about $\frac{1}{2200}$ in diameter; very equable, with few or no ribands; several spongy warts, called nips by the cotton-spinners, which adhere to the sides of the filaments; these are frequent on the finest Sea-island cottons; crimped transversely by the effect of age, and apt to break at these points of shrinkage.

C. 6. 1826. Not so good as the preceding. Cost 5*s*. per lb. Extremely fine filaments, measure only $\frac{1}{3000}$ of an inch; considerably warty, with the appearance of shrivelling, and irregular contortions from age; spiry character.

A. A. 1832. Not so good for fine yarn as Wilson's. Cost 2*s*. 5*d*. Diameter of filaments from $\frac{1}{1500}$ to $\frac{1}{2000}$ with a few much smaller; pretty uniform and tortuous; few ribands; nippy or warty.

The above specimens were furnished by Mr. Houldsworth.

The following were from Mr. Cook:

Georgia Sea-island.—Filaments generally cylindrical, with occasional spires, like a screw; a few of riband-shape; diameter from $\frac{1}{1500}$ to $\frac{1}{2000}$ of an inch; a very uniform cotton.

Georgia Upland.—Some thin ribands; but the general character of the filaments is spiry cylindric, like the Sea-island, but less uniform in diameter, and about one half its length; a few very fine filaments of perhaps $\frac{1}{6000}$ of an inch diameter.

Maranham.—Cylindrico-spiral, but the fibres vary in diameter from $\frac{1}{1500}$ to $\frac{1}{3000}$; a few ribands $\frac{1}{1000}$ broad.

Demerara.—Very spiry flattened cylinders from about $\frac{1}{1500}$ to $\frac{1}{2000}$, a few much smaller; hardly any ribands.

Surinam.—Fibres pretty cylindrical of about $\frac{1}{1500}$ diameter; many of them screw-shaped, and a few very small; but on the whole this is a very regular wool.

Pernambuco.—Cylindrico-spiral filaments from $\frac{1}{1500}$ to $\frac{1}{2000}$; a few twisted ribands of $\frac{1}{1000}$ broad; several warty excrescences on the sides of the filaments.

Bahia.—Thin cylindrico-spiral filaments, mixed with several ribands spirally twisted; diameter about $\frac{1}{1200}$; no perfect cylinders.

New Orleans.—Cylindrical fibres with many spires, about $\frac{1}{1400}$, mixed with several far finer threads.

Para.—Regular ribands, mostly thin and about $\frac{1}{1300}$ broad; few fibres of cylindric form; no regular screws, but a few ribands coiled in open spires.

Carthagena.—Mixture of ribands and flattened cylinders, the former about $\frac{1}{1000}$ broad, the latter $\frac{1}{1500}$ diameter; a few spires; wool very unequal.

Grenada.—Mixture of cylinders and ribands of about $\frac{1}{1500}$; several spires, and a few very slender filaments; a fine cotton, but not very equable.

St. Domingo.—Chiefly narrow twisted ribands from

$\frac{1}{1000}$ to $\frac{1}{1200}$ broad, with a few flattened cylinders; and some spiry fibres.

Earsden Egyptian.—Uniform spiro-cylindrical filaments, from $\frac{1}{1500}$ to $\frac{1}{2000}$; few thin ribands, all translucid.

Smyrna.—Ribands from $\frac{1}{900}$ to $\frac{1}{1500}$; a few cylindrical fibres, but hardly any spires; some of the ribands irregular and very filmy, with embroidery veins.

Bourbon.—Fibres less cylindrical than the Surinam; many of them only $\frac{1}{2000}$ in diameter, mixed with ribands from $\frac{1}{1000}$ to $\frac{1}{1500}$ broad; filaments uniformly fine, but not very spiry.

Lady Flora Madras.—Very unequable wool; flimsy ribands mixed with several cylinders slightly spiral; a few warty excrescences; diameters from $\frac{1}{1000}$ to $\frac{1}{2000}$.

Mount Stuart Elphinstone Surat; good.—Many ribands $\frac{1}{1000}$ broad, mixed with cylinders, from $\frac{1}{1500}$ to $\frac{1}{2000}$; very little spiry appearance.

Esther Surats, good, fair.—Many ribands from $\frac{1}{500}$ to $\frac{1}{1000}$ broad and flimsy in texture; hardly any cylinders.

Royal George Surats, middling.—Flimsy contorted riband from $\frac{1}{600}$ to $\frac{1}{1200}$ broad; hardly any cylinders; a few warts.

Easor Bengal.—Groups of irregular flimsy ribands, with a few small flattened cylinders, from $\frac{1}{1000}$ to $\frac{1}{1500}$.

The fibres terminate usually in very fine points, abruptly tapered. To these points the mechanical

Fig. 8.

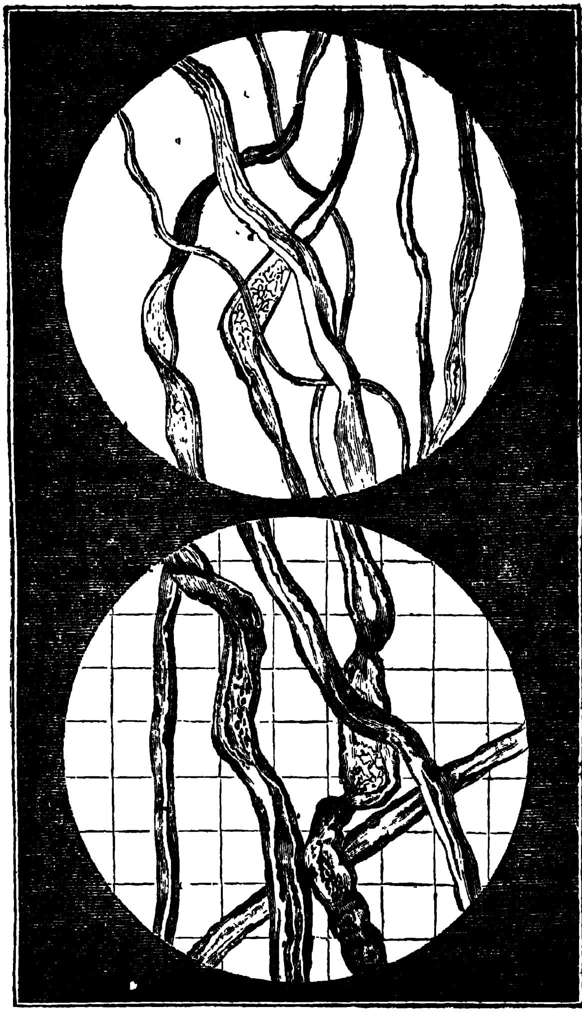

Fig. 9

Fig. 8.—Surat Cotton.

Fig. 9.—Smyrna Cotton, shown upon the micrometer lines, in glass, $\frac{1}{1000}$ of an inch apart.

irritation of cotton, when applied to ulcerated surfaces, may probably be ascribed; and possibly in some measure to the exceedingly fine edges of the ribands. Flax or lint consists of smooth cylinders, and is therefore free from the irritating quality. The entanglement of cotton filaments, to which their superior spinning properties are owing, may be ascribed chiefly to their spiral structure, and elasticity; so that when one is pulled out, it draws forth many others. If, during this extrication of the filaments, a twisting motion be communicated to them, they will form a cohesive thread. The finer, the more uniform, the more cylindrico-spiral, the longer and more elastic the filaments are, the more capable they will be of forming fine yarn. When they are short, and consist of rather broad and flimsy ribands, they will be ill adapted to machine spinning, though still susceptible of being spun by the tact of delicate fingers. We can thus understand how the Hindoo women manage to spin fine yarn from the Dacca cotton, which is the growth of an unequable wool consisting of flimsy ribands, like most of the India cottons.

The most intelligent manufacturers at Dacca, says Roxburgh, think that the great difference between the Dacca muslin and that of other places, lies in the spinning, and allow little for the influence of the soil, or the variety of the *gossypium herbaceum,* which is cultivated at Dacca.

There can be no doubt that the cotton filaments are hollow cylinders, prior to the dry state of maturation, they then become flattened and tortuous, in a greater or less degree. The more nearly cylindrical they remain, the stronger and more pliant to the spindle will they be

found. On these accounts, as well as from their greater length, the filaments of the Sea-island, Egyptian, Guiana, and Brazilian cottons hold a higher value in the market, than the Upland Georgian, or the East Indian. In examining a sample of cotton wool, the spinner draws it out slowly between the fore-fingers and thumbs of his two hands, and observes how the filaments successively escape from pressure. He then draws out the staple in the other direction, and thus alternately from hand to hand. In this manner he judges of the length, smoothness, fineness, and strength of the cotton. Of the strength, however, a better judgment may be formed in the yarn, by seeing what weight will break it.

One sort of cotton is seldom worked up alone in our cotton-mills, but two or three different kinds are frequently mixed together. Thus the cheap and short stapled cottons of India, must be willowed and carded along with some of the American cottons, to make them work to the best advantage. Much of the success and profit of the cotton spinner, depends on the skilful blending of dissimilar cottons, whereby one kind is made to conceal or supply the defects of another.

The relative value of different cottons is exactly represented in the table of prices current, published by the brokers. Thus at Liverpool, on the 1st December, 1835, the best cottons of each name were sold at the following prices per pound, duty paid:—

	s.	d.		s.	d.
Sea-island	1	6	to	2	6
Demerara and Berbice .	0	9	,,	1	0
Pernambuco	0	10¾	,,	1	1½
Egyptian	0	11½	,,	1	2½
New Orleans	0	7¼	,,	1	0

	s. d.		s. d.
Bahia	0 8¼	to	0 10
Upland Georgia . .	0 7⅛	,,	0 11½
West Indian	0 7¾	,,	0 9
Surat	0 6⅛	,,	0 8
Madras	0 6½	,,	0 8
Bengal	0 5¼	,,	0 6½

This order of price and value has remained, with slight exceptions, nearly uniform for the last twenty-five years. In this period, however, several improvements have been made in the mode of cultivation and cleaning, especially in the interior of Georgia and Carolina; and yet their cotton stands beneath others, in the growth of which probably less skill is applied. It is hence manifest that a good deal depends on the soil and climate. One point is clearly fixed; the superiority of cotton grown near the sea, to that grown inland, the soil and climate being similar. This fact leads to the conclusion that the saline matters near the shore, so remarkable in the Sea-island plantations, must supply a food propitious to the growth of good cotton. How far this inference is well founded will appear from a consideration of the chemical constituents of cotton.

In the year 1825, a dispute having arisen between some eminent calico-printers concerning the validity of an ingenious patent, I was employed to analyze certain kinds of coloured cotton goods, and to compare the results with the analysis of clean cotton wool. Having procured a fine carded fleece, from a spinner who used chiefly the Sea-island cotton, 2,000 grains of it were slowly burned in a silver basin; the residuum being thoroughly incinerated at a red heat, to consume every particle of charcoal, formed a light

grey ash. The weight of this ash, upon an average of six similar experiments, was nineteen grains, being nearly one per cent, of the cotton wool.—*See Journal of Science for January*, 1826.

One hundred parts of these ashes yielded:

1. *Matter soluble in water, sixty-four parts*, consisting of—

Carbonate of potash . . .	44·8
Muriate of potash	9·9
Sulphate of potash . . .	9·3

2. *Matter indissoluble in water*—

Phosphate of lime	9·0
Carbonate of lime	10·6
Phosphate of Magnesia . .	8·4
Peroxide of iron	3·0
Alumina a trace, and loss .	5·0
	100·0*

The results of the preceding analysis seem to throw considerable light on the predilection of the cotton plant for the neighbourhood of the sea, which supplies plentifully the saline substances requisite to the perfect development and constitution of its woolly fruit. It may hence be inferred that the compost or manure best fitted for cotton plantations should contain neutro-saline matter with alkaline, calcareous, and magnesian bases. The presence of magnesia deserves notice, as it indicates marine food. Here, as in many other examples, the vegetative powers of the roots, seem to eliminate potash from the stone detritus of the soil,

* An Examination of the Differences in Chemical Composition between Cotton Wool, Cotton Cloth, and Turkey Red Calicoes, by Andrew Ure, M. D., F. R. S.

which replaces the soda in the sea salts. For otherwise we should have found salts with a basis of soda, instead of potash salts in the ashes of the cotton.

The following are the commercial characters of the different kinds of cotton wool imported into our market.

1. *American Cottons.*

Georgia Sea-island.—This is raised on the sea coast of Georgia and the small islands which form the neighbouring Archipelago. Though not decidedly yellow, it has somewhat of a dull butter tint, which distinguishes it from white cotton. It is remarkable for its long staple, the filaments being three times longer than those of the Indian cotton wool. It has a silky softness. It is sometimes dirty, but the well cleaned and the best is preferred to every other quality for spinning fine yarn; and indeed it is indispensable for the finest. The reason of this superiority appears to be the cylindrico-spiral form, and equability of its filaments, which facilitates their torsion into a uniform thread.

Georgia Upland.—This cotton grows in the interior of the country, as its name denotes, and though far inferior to the preceding, it is a valuable wool for coarse yarns. It is white, occasionally dirty, of a short unequal staple, light and weak. It was long called Bowed, because it was originally cleared from its seeds by the blows of a bow-string, a most fatiguing operation, which Whitney's saw-gin has superseded.

Tenessee.—Resembles the last sort, but is generally cleaner and better

New Orleans.—Like the last two, but somewhat superior.

Pernambuco.—Has a fine long staple, clean and uniform. It is much used by the hosiers.

Maranham.—This is not quite of so good a staple as the last, nor so well cleaned; it holds the same rank as Demerara cotton.

Bahia.—Slightly superior to Maranham.

Surinam.—A long stapled cotton, a faint yellow ting but a clean cotton; in request for hosiery.

Demerara.—This is a fine white glossy wool, gene rally very well cleaned, and picked before packing It spins into a clean stout yarn, and has now risen to a level at least with the Pernambuco.

Berbice.—Like Demerara.

Egypt.—This cotton has been much improved in the course of some years, by the enlightened policy of the Pasha. He imported seeds from Cyprus, Smyrna, Brazil, Georgia, and other countries, and has produced a cotton which occasionally comes near the Sea-island. It is seldom well cleaned.

West Indian.—In the Bahamas a tolerably good cotton has been grown from the Bourbon seed, though much inferior to the Bourbon itself. The staple is fine and silky, but the cotton is not well cleaned.

Barbadoes.—This is of middling quality; staple rather short, but silky and strong. It contains too much of the seed husk.

East India Cottons.

Bourbon.—This is the most uniform of the oriental sorts. It is clean, and has a fine silky staple. It

ranks next in value to Sea-island, but is not now imported into our markets.

Surat.—This cotton has an exceedingly short fibre, is dirty, being often mixed with leaves and sand.

Madras and Bengal.—These are much the same as the preceding sort. Some of the Madras cotton has been raised from Bourbon seed, but, from inferiority of soil and culture, it is little better than the common Indian cotton, which is the product of the gossypium herbaceum. These cottons can be spun into fine yarn only by the delicate fingers of the Hindoo female.

The following summary of the botanical species of cotton will probably accord best with commercial distinctions. 1. *Gossypium Herbaceum*, the herbaceous cotton plant; two to three feet high, of one summer's growth, with round capsules, about the size of a walnut, opening with three valves, and containing seeds of the size of peas. In Europe it is cultivated in Macedonia, Malta, Sicily, and Calabria; it grows also in the Levant and the East Indies. 2. The second species is likewise for the most part an annual, though it may occasionally last two years; it is the hairy cotton plant, *gossypium hirsutum*, which sometimes grows to the height of a man, with egg-shaped, four-celled capsules, as large as a middle-sized apple. It is a native of America, and is cultivated particularly in Carolina. 3. Among the cotton shrubs, with woody stems, is the *gossypium* tree, which grows from eight to twelve feet high in the East Indies, Egypt, and in some provinces of Spain. The yellow cotton plant, or *gossypium religiosum*, of India and China, as well as

the *gossypium Barbadense,* or the West India cotton, belongs to the *arborous kind.* The cotton-tree, *bombax pentandrum,* which grows in India and America, belongs to quite another family of plants from the *gossypium.* Its trunk, attains the height of twenty feet, and possesses considerable strength.

The capsules or seed-pods of all the cotton plants are at first green, but become afterwards brown, and sometimes nearly black. At the period of maturity they burst open with a slight explosive sound, when the wool must be immediately plucked, to prevent its injury or loss by the weather. It is then ginned.

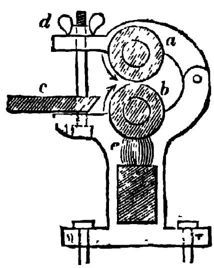

Fig. 10.—Section of Roller-gin.

Fig. 10 exhibits a section of the simple roller-gin; *a b* are the two rollers, each of which is about three-quarters of an inch in diameter, and six inches in length. They are made to revolve in opposite directions, as shown by the arrow, by means of toothed wheels, fixed upon the ends of their axes outside of the wooden frame. The under roller turns in fixed bearings, but each bearing of the upper roller rests at the extremity of an arm, which turns round a pin at *f,* so that by means of the adjusting screw *d* it may be brought nearer to the under roller in any desired de-

gree: *c* is the table on which the seed cotton is laid; and *e* is a brush placed beneath, which removes the filaments of cotton adhering to the roller *b*.

The general characters of a good cotton-wool are fineness, length, strength, softness, and equality of the filaments, and freedom from knots and impurities. The more remarkable it is for these qualities, and the less waste it suffers in spinning, the higher price it fetches. The cotton is commonly named from the country where it grows, each kind being classed into three sorts, the prime, the marketable, and the ordinary—the first being appropriated to warp or lace yarn, the second to weft of different qualities, and the third to coarser yarns. To judge of the species of cotton wool, the continental dealer takes a handful of it from the bag. This is pressed and drawn out between the thumbs and two forefingers, which affords an indication of its approximate length and fineness. This flock of filaments being again seized by the middle is drawn out once more, which affords a second indication. This process of arranging the filaments in a parallel riband is many times repeated, till their average length, softness, fineness, and strength, are determined. The experienced cotton broker and spinner acquire a remarkable delicacy of tact in this way, so that they can decide in the dark upon the country, quality, and price of the cotton wool. By a suitable mixture of a little long stapled cotton wool with short stapled, the latter becomes susceptible of being spun into much better yarn than it could afford of itself. Sometimes also the long stapled will bear a considerable admixture of the short stapled without losing its fitness for furnishing fine yarn.

The following are the most common distinctions of cottons recognized on the continent of Europe: 1, the North American; 2, the West Indian; 3, the South American; 4, the East Indian; 5, the Levantine; 6, the African; 7, the Italian; 8, the Spanish.

1. Among the cottons of North America, or the United States, are to be noted that of Georgia short and long stapled, Louisiana, New Orleans, Carolina, and Tenessee. The short stapled Georgia is worked up chiefly into the coarser yarns of No. 30 and under, but when mixed with the Egyptian Mako, it may be spun up to No. 40. The bluish-white cotton of Louisiana is of a better quality, but ranks below the long stapled Georgian, the Brazilian, and certain of the West Indian cottons. It is fit for spinning as high as No. 50, but is sometimes deteriorated by a number of little seeds left in it by imperfect ginning. The Carolina is also preferred to the Upland Georgia, as well as the cotton of Tenessee and New Orleans, which are often weak-fibred; yet some of the latter are fine enough to spin yarns as high as 100.

2. The West Indian cotton wools of the best sorts resemble in length of staple the Sea-island, the Bourbon, the superior Spanish, and the South American. That of Porto-Rico, is held to be the best; after which come the others in the following order nearly: Curaçao, St. Domingo, Martinique, Guadaloupe, Barbadoes, Jamaica, St. Christopher, St. Lucie, St. Thomas, Grenada, St. Vincent, Dominica, Tortola, Montserrat, Bahama, Cuba, St. Jago, Antigua. The last may rank with the best of the Levant cottons. Of the West India cottons it should be remarked that their cultivation has been much neglected of late

years, since sugar came so much into play; and that their qualities do not correspond with the above, which is their ancient and natural order. The Guadaloupe has often a reddish tinge, has a long staple, and is easy to spin. It, and the best of the St. Domingo wool, will furnish yarn as high as 100 in number.

3. South America is capable of affording excellent cotton wool, of which the best example is the Brazilian called Maragnan, Bahia, and Pernambuco, which have sometimes been made into yarn as fine as No. 200, and upwards. They deserve to be placed immediately after the Sea-island Georgian and the Bourbon, although the Maragnan is often ill cleaned. The Minas-Geraes, the Para, and Ceara are of inferior quality, and are rarely spun into finer yarn than No. 60. The Rio Janeiro is a slight, dirty, and dingy kind of cotton wool, upon a par with the worst sorts of the West Indian. Among the remaining varieties of the South American, the Cayenne is most esteemed, on account of the length, whiteness, and lustre of its filaments, and it may be classed with good Brazilian. After it, comes the Surinam, with long yellowish staple, which has been occasionally spun into No. 200; those of Demerara, Essequibo, and Berbice are generally inferior, as well as of Lima, the Curaçaos, and Cumana. The Carthagena is coarser and dirtier than the preceding, but has greater length and strength of staple.

4. The East India cotton wool is, generally speaking, inferior to the American, and even to the better sorts of the Levant cottons. The Surat, which is the most abundant, is ill cleaned, yellowish, tolerably fine, but very short in the staple. The Madras, Siam, and

Bengal are of very variable quality. The last is white, silky, and has sometimes been spun into No. 50. The Nanking cotton was at one time celebrated, but it is now little known in Europe.

5. Under the Levant cotton wools are comprehended all those grown in European and Asiatic Turkey; such as that of Macedonia, of Smyrna, and the Levant properly so called—all of which are distinguished by considerable whiteness, but have a moderate length of staple, so that they can rarely afford yarn finer than No. 60. The best kinds of the Macedonian cotton are the Uschur or the Zehent wool, and the Salonichi; Cira wool is a very poor article, not workable into finer yarn than No. 20. A great variety of cottons come into the market under the name of Smyrna, because this is the general shipping port for most of the cottons of Turkey in Asia. They are perhaps inferior to the best Macedonian and East Indian, and furnish chiefly coarse weft yarns, and candle wicks. The best varieties are the Arar, Kassabar, and Kirkadadoch. The most highly esteemed sorts are the Subuschat and Kinik; those of Cyprus and Acre are inferior; the worst are those of Bender and Altah.

6. Africa furnishes from the isle of Bourbon the best species of cotton wool, almost as much prized as the finest Sea-island, but it suffers a greater waste in the manufacture. It is uniform, clean, fine, and silky, rivalling the Levant in whiteness; it may be spun into the finest yarn. The Egyptian or the Alexandrian cotton wool, known in commerce under the name of Mako or Maho, has a fine readily twisting filament, admits of being mixed with other kinds of cotton wool,

but is often foul and interspersed with unripe fibres. It has of late years quite supplanted the Macedonian in the cotton manufactures of Austria. The Senegal cotton ranks with the middling cottons of the West Indies, and with good Levants.

7. The principal cottons, known in trade under the title of Italian, are grown in Malta, Sicily, and Naples, the Sicilian being the best; the next are the cottons of Castellamare and Della Torre in the neighbourhood of Naples, which approach in quality to the cotton of Louisiana. The Malta cotton ranks with the inferior West Indian. The Biancavilla, a variety of Neapolitan cotton, suits well for mixing with the Mako, and then affords (in the proportion of three to two of Mako) a good yarn of from 30 to 50 in fineness of number. Mixed with Upland Georgia it is spun into Nos. 30 and 40.

8. The best kind of Spanish cotton wool is the Motril, from the kingdom of Granada, which deserves to be placed immediately next to the first Brazilian. From the fineness of its staple it may be spun into yarns of a high number.

CHAPTER II.

Of the Cultivation of Cotton, or Cotton Husbandry; and the Cotton Wool Trade.

HAVING been favoured by two of the most scientific and successful cotton planters in Georgia, Thomas Spalding, Esq., of Sapelo island, near Darien, and Whitemarsh B. Seabrook, Esq., of Edisto island, with two manuscript memoirs upon the culture of the gossypium, I gladly avail myself of the liberality with which they have contributed, at my request, their valuable services to the present work.* The information thus freshly drawn from the fountain head, shall be presented to my readers as nearly as may be in its original form. It will prove highly interesting to all who are engaged in this spreading branch of agriculture, but more particularly to our adventurous countrymen in India, where the cotton husbandry has been heretofore grossly mismanaged, as appears from the testimony of Dr. Wallich, and other competent observers.

Mr. Spalding considers that in reference to cotton grown in the United States, only four species of the gossypium need be considered.

* The request was conveyed through my very intelligent friend Edward Woolsey, Esq., of Leman Street, London, to Thomas Cooper Vander Hurst, Esq., of Woodlands, Carolina, who applied to the gentlemen whom he knew to be the most skilful planters in Georgia for the best information on the subject.

1. The *herbaceum*, having a smooth stalk two feet high, branching upwards, with five-lobed smooth leaves, and yellow flowers at the end of the branches; the flowers being in harvest-time replaced by roundish capsules full of seed-cotton.

2. The *hirsutum*, or hairy American cotton, has hairy stalks branching laterally, two or three feet high, palmated three and five-lobed leaves, with yellow terminal flowers, replaced by large oval pods filled with seed-cotton.

Fig. 4, p. 63, represents this species, being carefully copied by the wood-engraver from a coloured drawing of the Upland cotton plant by Dr. Capus, transmitted with the memoir of Mr. Seabrook.

3. The *Barbadense*, or Barbadoes shrubby cotton. It has a shrubby stalk branching four or five feet high, three-lobed smooth leaves, glandulous underneath, with yellow flowers, replaced by oval pods filled with seed-cotton.

4. The *arboreum*, or tree-cotton, has an upright, woody, perennial stalk, branching six or eight feet high, palmated four or five-lobed smooth leaves, with yellow flowers filled with seed-cotton.

The seeds of the first and second varieties, besides the proper filaments of cotton-wool which invest them, are covered entirely in the second, and partially in the first, with a dense short fur, resembling closely the under fur of a hairy animal. In the United States all the cotton seeds have an increasing tendency to get a clothing of fur, whereby they become more difficult to clean, but are in no other respect deteriorated. Whether this change arises from some regular law of nature, which promotes the formation of fur on trans-

ferring plants and animals from a hotter to a colder climate, or from some accidental intermingling of the seeds or pollen of the plants, must be left for future investigation.

The Sea-island cotton of Georgia, and likewise of Carolina, is derived from the fourth, or what Mr. Spalding calls the tree-cotton. It would be perennial did the climate permit, as is proved by the circumstance of its lasting many years when the soil is new and propitious. He has known it in warm alluvial lands to survive for five years, and has often seen it vindicate its title of Arboreum, or tree-cotton, by the height to which it grew; for he has measured plants eighteen feet high, which assumed the character rather of trees than of shrubs. But when the plant grows so large, it yields no return of cotton-wool to the cultivator, for it continues to be covered with blossoms or unripe pods when the winter sets in, and is very liable to be blighted in a single night by the action of frost at any period after the 1st of November.

Fig. 3, p. 60, exhibits the Sea-island cotton plant, from a coloured drawing also sent me by Mr. Seabrook. I believe these two figures to be the only exact representations of the Gossypium hitherto published in connexion with the commercial quality of the filaments. "When the Sea-island kind was first introduced into Georgia," says Mr. Spalding, "it was very subject to this overgrowth; and though my memory is fresh as to the time, I do not remember of a single pod having rewarded our first labours by giving the promise of ripeness in a future season. Fortunately the winters of 1785 and 1786 were mild, and the cotton then under experiment had been mostly planted

in new, warm, and fertile soils; the frost penetrated slightly into the earth, and did not extinguish the life of the plants, but suffered them to resume their vegetable activity in spring. Those cotton stalks which had been killed by the cold weather were cut down to the surface of the ground, and the shoots that grew up from the roots of the preceding year's plants were earlier in their development, came sooner to maturity, did not rise so high, displayed their blossoms fully, and more speedily formed their pods. In the second year of this great agricultural era the plants bore their fruit seasonably, and ripened it well, being by this time somewhat acclimated. Expectation was now on the tip-toe, holding forth hopes to the United States of their becoming ere long a great cotton country.

"The mighty revolution thus commenced in the manufactures and commerce of nations was the work of a few active minds scattered through the two Southern States of the American Union, not cheered in their difficult and doubtful enterprise by the bounties of their own government, or by the diminished duties of others, but rather put to the ban of two rival empires in the old world and the new, by which they were alternately harassed by tariffs and commercial restrictions at home on exportation, and increased taxes on importation into Europe.

"Labours destined at no distant period to give freights to thousands of ships, as well as profitable employment and cheap clothing to millions of men, women, and children, were for a long time placed in the most vexatious jeopardy. But leaving bad and blundering statesmen in the hands of Him who visits the sins

of the fathers on the children to the third and fourth generation, we shall proceed," says Mr. Spalding, "to describe one of the most useful forms of industry.

"The provinces from Virginia to Georgia had been colonized by the mother country with commercial views, and the persons who had migrated to them were not the exiles of oppression in laws and religion, but had crossed the Atlantic in order to better their fortunes under the auspices of the English government; hence, when the war of the American revolution began, the distractions about to break a great nation in pieces, which had for the first time, at least in modern history, originated with the rulers and not with the people, created dissensions among the Southern colonists, many of whom thought the remote evils from unrepresented taxation should be borne in preference to the immediate desolation of civil warfare."

After America had established its republican government, Great Britain, feeling bound to make a provision for those colonists who had espoused her cause in the war of independence, offered them portions of land in Nova Scotia and the Bahama Islands. At this conjuncture Arkwright was maturing his spinning machinery, and creating a considerable demand for cotton wool, which induced the colonists who crossed over from the Bahamas to turn their attention to the cultivation of the cotton plant, and to procure the best species of seed then known in the world. The small isle of Anguilla, in the Carib Sea, long celebrated for the excellence of the cotton wool raised upon it, furnished the first seed to the Bahama settlers; by the year 1785 they had succeeded in raising cotton upon two of the Bahamas, viz., Long Island and Exuma.

Mr. Spalding's father, then settled in Georgia, received from Colonel R. Kellsall, a planter in Exuma, a bag of cotton seed; some other Georgians also received similar contributions from their former companions.

Josiah Tatnall may be particularly mentioned in our history of the cotton husbandry of the United States, as a person who received a supply of cotton seed from his father, surveyor-general of the Bahamas. From that handful of seed sent over in the winter of 1785, all the Sea-island cotton plants of Georgia and South Carolina have been produced.

There is a long range of islands lying between George Town in South Carolina and St. Mary's in Georgia, which extends from 32° 30′ to 30° of North latitude, through a space of about 200 miles. These islands were originally covered with live oak, and the other evergreens of a Southern climate; they had been the abode of a particular tribe of the red men of the West, who were fishermen rather than hunters: the accumulation of oysters, clambs, and other kinds of shells mingled with the remains of the bones and pottery of the ancient Aborigines is so vast as to fill every stranger with astonishment; and these calcareous matters had become intimately mixed with the sandy soil and decayed vegetables into a peculiar loam, of a light and fertile nature. A former colony of English settlers had made the shores of these islands the sea. of some indigo plantations. It was upon two of these islets, separated from the continent by a few miles of grassy salt marsh, that the Sea-island cotton was first made to grow.

" If Frederick the Great has been admired for honouring the farmer who first cultivated a superior

species of rye in Prussia, what honour is due to the ingenious planter who first produced the admirable long-stapled silky cotton, without which the spindle and bobbin could never have rivalled the finger and thumb of the Hindoo in spinning muslin yarn, and the cotton trade of Europe would have been still tributary to India for all the finer fabrics! The following names of the first growers of Sea-island cotton deserve to be recorded,—Josiah Tatnall, and Nicholas Turnbull, on Skideway island, near Savannah; James Spalding, and Alexander Bisset, upon St. Simon's Islands, at the mouth of the Altamaha; and Richard Leake, upon Jekyll Island, adjoining St. Simon's. For many years after the introduction of the Anguilla cotton-seed it was confined to warm high land in the above islands, under the influence of a saline humid atmosphere; gradually, however, the cotton-husbandry was extended to the lower grounds, and beyond the limits of these islands to the adjacent shores of the Continent; latterly, even to the coarse clay soil deposited by the great rivers at their confluence with the sea-tides. In all these grounds the cotton-plant thrives well, and produces a long stapled wool."

The only essential point seems to be a saline atmosphere; with it any soil in Georgia or Carolina may produce fine cotton, without it no soil will do so.

It is within the district from St. Mary's in Georgia to George Town in South Carolina, extending not more than fifteen miles inland, that the Sea-island cotton is still confined. Whenever its cultivation has been attempted, to the North, South, or West beyond these limits, a certain decline in its quality has been observed to take place.

Many variations have occurred in the cotton-husbandry since it became an object of importance; when first attempted, the farmers deposited the seed either in hillocks raised slightly above the general surface, or in holes five feet asunder every way; the interjacent spaces being dug up, pulverized, and kept free from grass and weeds by the hand-hoe or the plough. But it was soon perceived that this scanty sowing was apt to leave a great portion of the field unoccupied with plants, and was consequently an unproductive mode of farming. As the cotton plant is one of the tenderest scions of vegetable life, it was found necessary to increase the quantity of seed in order to ensure a sufficient number of healthy plants on a given surface of ground; fortunately Tull's ridge-husbandry became known to the colonists, and was adopted for the Sea-island cotton with great success.

The present process, which has continued without change for the last twenty-five years, is to form the ground into ridges, five feet in breadth, extending in straight lines over the whole field; if the land be at all low and subject to be overflowed, these ridges are intersected by ditches at intervals of 105 feet from each other, for receiving the water that may collect in the hollow spaces between the ridges on which the cotton plants are reared. These hollows correspond to the water furrows in wheat husbandry, and serve the same purpose of drainage; the ridges should rise about ten inches above the level of the intervals, the crown being flat and regular; a trench is then made along the middle of the ridge, from two to four inches deep, according to the time of planting, which extends from the 1st of March to the 1st of May, the pre-

ferable period being from the 1st to the 15th of April. When cotton is planted early in March, before the sun has warmed the soil to any great depth, it is necessary to deposit the seed in drills, not more than two inches deep, or there will not be warmth enough to excite germination; later in the season, when the heat is greater, moisture must be secured, which is done by making the drills four inches deep.

The Georgian has been taught by experience not to be sparing of his cotton seed, and he therefore commonly uses a bushel to the English acre. The persons employed in sowing the cotton are generally divided into parties of three individuals each; one person opens the drill along the top of the ridge, then the most intelligent drops the seed into the trench, and the third follows with a hand hoe to turn back the soil while still moist over the seed in the trench; this operation may be very well performed by the foot, by the pressure of which the crumbling soil may be brought into close contact with the seeds. Women are principally employed in these rural labours.

After every care in the sowing, the planter is never sure that a sufficient number of plants will spring up, for a single night's frost, often so late as the month of April, will ruin the whole prospect, and require a renewal of the labours; nay, one day of a strong north-east wind will blight a field of promising plants, and, upon the best and richest soils, when both these sources of danger are past, there is another enemy equally destructive,—the cockchafer or cutworm, which prevails in the month of April: as the cotton comes through the ground and remains several days, like the pea or other pulse, with only two radical leaves, every one of

the plants cut above or below the ground by the worm is destroyed, in consequence of which whole fields have not unfrequently to be replanted in the month of May.

When apprehension from these accidents is over, the labour comes on of thinning the plants, which would injure each other, from being too much crowded together; the prudent husbandman divides this labour into three periods, successively weeding out the weakly plants as the vigorous ones increase in size, to be left to grow from six inches to twenty-four inches apart, according to the fertility of the soil and the expected size of the shrub. The cotton plant is of the tap kind, which sends its root straight down into the ground, and draws much of its nourishment from the atmosphere by means of its broad leaves; as the fields should be entirely shaded from the sun when the plants are fully developed, the distance between their roots should be adapted to this circumstance.

At every one of these thinnings, as they are called, the field is carefully cleared with the hand-hoe from weeds, and fresh soil is gathered round the remaining plants to support them against the wind, whereby they are easily bent over on account of their tall slender stem; these several operations continue till about the 20th of July, by which time they have been repeated from three to six times successively, according to the soil and season, and at that period the summer rains usually set in; they are not tropical in their violence, but are often pretty heavy; up to that time of the year no country can possess a more temperate climate than the Sea-island district; the atmosphere feels springy and enlivening, being refreshed by gentle winds which blow almost daily from the sea-shore. But dark and

dense clouds now begin to gather upon the Western hills, and the equilibrium of the weather becomes unstable; from the 28th of July to the 1st of August the winds change their direction from the South-east to the South-west, and are accompanied with clouds replete with lightning and rain to deluge the fields. At this season all field-labours must cease, for any attempt to stir the ground now would be apt to loosen the roots and make the plants with their large leaves overloaded with moisture fall down; indeed, they are only sustained in consequence of the repeated dressings up of the soil round their roots at the previous operations. The month of August is a period of great solicitude to the cotton-grower, as the heavy rains frequently cause the plant to part with its fruit, and even its leaves; the August full moon is likewise the time when the caterpillar makes its appearance. It is the offspring of a small brown moth, resembling the candle moth, which deposits its eggs upon the leaf of the *Gossypium* always a night or two before the full or new moon; they hatch a few hours after they are deposited, and are so small at first as to be hardly discernible by the naked eye; they do little or no damage during the first nine or ten days of their life, like the silkworms, eating little in their infancy; but a few days before they complete their growth they become so excessively voracious as to destroy an entire plantation in a few hours. Mr. Spalding has seen 400 acres of cotton of a promising aspect, which four days thereafter did not possess a green leaf, or scarcely a solitary pod upon a plant.

Experience has led to the belief that these caterpillar ravages may be expected once in the space of seven years.

When cotton fields have escaped injury from rains,

winds, and worms, they display as beautiful a scene as the admirer of vegetable nature could desire to behold: wide waving groups of viny foliage blended with three coloured blossoms of brilliant hues, and pods of darker shades in various states of ripeness. When the flower comes forth it has a fine yellow colour, which it retains during the first day; under the influence of the night it changes to a red or crimson hue; in the third day it darkens into a chocolate brown, and then falls to the ground, leaving a pod already half an inch in diameter. The interval between the appearance of the blossom and the maturation of the fruit is very variable, being altogether dependent on the season. Mr. Spalding has at one time observed hundreds of flowers which afforded perfectly ripe fruit in the space of twenty-one days, and at another he has seen six weeks required for the same effect, but such delays are always hurtful.

The cotton pods begin to open about the 1st of August; from which time to the 1st of December the whole attention of the cultivator is directed to the *picking in* of the cotton as the pods daily open. During the autumnal season in Georgia and South Carolina upon the sea-coast, the winds are violent and the rains heavy, so that the picking is a tedious though not a laborious operation; and the persons employed may be expected to gather from the fields twenty-five pounds a-day when the weather permits them to work. In the more favourable times, fifty pounds is a good daily average picking of seed cotton; but latterly ten pounds may be a day's work.

Taking the mean product of cotton plantations, Mr. Spalding considers that four acres will not yield more

than five hundred weight of clean cotton separated from the seeds by the gin, of which four hundred weight is white, and one hundred weight coloured or stained cotton wool. These five hundred weights of cotton wool have averaged to the planter for the last fifteen years twenty cents (about 10*d*.) per pound for the white, and ten cents for the stained, fetching in American money ninety dollars to the husbandman. Mr. Spalding justly remarks, that this is a small remuneration, not calculated to excite the envy or hostility of those engaged in other productive occupations.

The process of preparing Sea-island cotton for the market begins as soon as it is generally gathered in from the field, and it is tedious and troublesome in a high degree. The seed cotton, as plucked from the pod, is put into a bag to the amount of about half a bushel, the bag being suspended from the neck or waist of the reaper; when full, it is emptied into a large basket, which contains the amount of each person's gathering in the course of a day. In the evening the crude cotton is brought home, weighed, and deposited in the storehouse; whence, next morning, if the weather be fine, it is taken and spread upon drying-floors, made of two-inch thick American pine; from twenty to forty feet of floor being required for every hundred acres of cotton under cultivation. One day's exposure here is sufficient for cotton plucked in dry weather, but several days may be required for the cotton picked during rain. As strong cold drying winds and bright suns are equally injurious to the delicate staple of the Sea-island cotton, it is left no longer upon the drying-floors than is absolutely necessary to prevent it from heating in the house by fermentation. It is also usual and

proper to pass it through what is called a whipper, to strike off any sand, broken leaves, or other extraneous matter.—*See the Primitive Willow,* vol. ii. p. 4.

The whipper is a long cylindric cage made of reeds or bars of wood (and might be made of wire) six or eight feet in length, and two feet in diameter, being close at one end and open at the other; and is supported at the two ends by feet of different lengths, so that the barrel slopes from the horizontal position about one foot. At the higher end, a hopper of about a bushel capacity rests upon the upper sides at the enclosed end of it. This hopper lets the cotton to be cleaned fall into the barrel or cage, along the axis of which a shaft runs which may be turned round by the hand, by a crank or winch attached to the shaft at its upper end. This shaft has cross bars upon it which reach to within an inch of the inside of the cylindric cage. The cotton as it falls from the hopper is whisked round about by these cross bars all the way in its descent towards the lower end of the cage, by which means any sand or other impurities fall through the interstices. This machine resembles in form and effect the bolting-sieve of a flour-mill.

The *whipping* was formerly applied both to the ginned cotton wool and to the seed cotton, but it is now confined to the last operation, as it was supposed to produce a stringy appearance in the cotton wool. When these operations are completed the harvest may be considered as closed, and the preparation of the wool for the market begins.

Many machines have been designed for separating the seed from the Sea-island cotton, but all at last resolve themselves into two wooden rollers, revolving

against each other in opposite directions; see fig. 10, p. 90. The rollers may be about half an inch in diameter, and turn round from 100 to 500 times in a minute. It is found that the smaller the rollers, and the slower their motion, the more cleanly will the cotton fibres be separated from the seeds; for, if the rollers be an inch in diameter and if they revolve very rapidly, they will draw in soft seeds, small and false seeds, or motes as they are called, and crushing them in their passage, will stain and otherwise injure the cotton staple. Much money has been expended upon complicated machines, driven by the power of horses, water, or wind, at first in the Bahama islands, and afterwards in Georgia and Carolina, "but at last most of the growers of Sea-island cotton have returned to their first and most simple tool,—*viz.*, two wooden rollers, kept together by a wooden frame, and inserted into iron cranks, having a round journal, and a square shaft, upon which is fixed a wooden or iron fly wheel from two to three feet in diameter. The iron cranks which turn the rollers are connected by strips of wood with a treadle worked by the foot. This treadle runs under the machine, and is connected at the further end to the floor of the house (like the treadle of a turning-lathe) by sockets within which it moves. The man stands therefore in front of the rollers, with a board interposed, upon which he holds a large handful of Sea-island cotton, which he presents from time to time to the rollers kept revolving by the action of the foot upon the treadle. This labour becomes easy from habit, as the feet may be changed in the operation. The task expected from the labourer upon this machine is from twenty-five to thirty pounds

weight of cotton per day. The gin itself costs when new and complete ten American dollars. Women are reckoned the best *ginners*, as they are more careful to keep the rollers supplied with wool in the act of revolution, but they were found to injure their constitution, and they have been replaced generally by men. As it is a light indoor winter work, it is much sought after by them.

"What is a little surprising," says Mr. Spalding, "this foot-gin which we received from the West Indies, is mentioned, if I mistake not, in the remains of Nearchus's voyage down the Indus, as employed in these countries for separating the seed from the wool."

The seed cotton is prepared for the ginning by careful inspection and sorting, in which the yellow cotton, the motes, and any hard or rotten fibres that may have passed through the whipper are separated from the white wool. This work requires the greatest care and attention, and is well executed by women seated upon benches, with tables before them, where the seed cotton as taken from a basket is spread in small parcels, examined, picked, and then thrown into another basket. A woman may sort from 60 to 100 lbs. in a day. It is now exposed for a little to the sun to take off any remaining dampness, and immediately thereafter subjected to the ginning machine. The wool thus separated from the seeds is again returned to the women placed in a large room well lighted and furnished with small tables, covered with slit reeds or wire-work; and it is here freed from every impurity. Thirty pounds are a good day's work for a woman. The cotton is now ready to be bagged for the market.

The hempen bags in which Sea-island cotton is shipped are made of Scotch sackcloth, forty-two inches wide in the web, weighing about a pound and a half to the yard. Each bag requires from four and a quarter to four and a half yards, and ought to receive fully 300 lbs. weight of cotton. Two men are generally employed together to pack, and they finish two bags in a day.

The room into which the cleaned cotton has passed is set apart for the packing operation, and must be kept free from dust. Adjoining to it is a small apartment under the same cover with a round hole in its floor, just large enough to contain the bag when full of cotton. The open end of the bag is fastened by twine to a wooden hoop which extends beyond the hole, so as to hang the bag upright by its mouth. One of the men then gets into the bag with a heavy wooden or iron pestle in his hands, and first presses the cotton with his feet as it is thrown in, and then beats it down with the pestle until the requisite quantity is forced into the bag.

Let us now compute the quantity of labour expended upon each 300 lbs. bale of Sea-island cotton before it is shipped: 1000 lbs. of seed cotton are required to produce 300 lbs. of marketable cotton wool; and fifteen persons are employed in its preparation for the gin. Twenty-five pounds are the average produce of a gin *per diem*, so that twelve days' labour are required to gin a bag full, and ten women take a day to mote the cotton wool. Thus thirty-eight days' service, including the packing, are worked up in preparing a bag of cotton wool for the market. Two others are usually employed in spreading the cotton

that is to be ginned upon the drying floor. The bag itself costs, with cord, &c., a dollar and twenty-five cents of American money. This sum with seventy-five cents for freight is to be deducted from the price of the cotton, as no return is ever made for the bag by the purchaser.

The quantity of Sea-island cotton has not materially increased within these last ten years, nor is it likely that it will increase. The particular soils and climate which have heretofore produced it, and to which it probably owes its peculiar qualities, are confined to the narrow limits above stated. Whether it be that the cultivation of the Sea-island cotton has afforded fewer inducements than other objects of husbandry, certain it is that the number of those engaged in it, even within these limited districts, has not increased; and they are the successors of the first cultivators who are still engaged in the business. They are generally an educated people and stationary, less anxious for change than most of their countrymen, and not indifferent to the honour and happiness of their fatherland.

The short staple cotton, so called in contradistinction to the Sea-island or long staple, wherever grown in the United States, is derived from the first and second of the four varieties above-described. They were both cultivated in small quantities in the United States from Georgia to Virginia at the close of the revolutionary war, by the poorer classes of the white population, for the purpose of mixing with sheep's wool in their domestic manufactures. The cotton was at that time separated by the old and young, labouring with their fingers, as they sat round

their evening fire, and was spun by the women upon the hand-wheel. But it was not till after the introduction of the West Indian seed that the short-stapled cotton was cultivated for the market. There can be no doubt, however, that a different cotton seed was at a subsequent period introduced into Virginia from some part of the Turkish dominions, most probably from Smyrna, and this is the *herbaceum* of Linnæus.*

No sooner was the attention of the southern States excited towards the culture of cotton as a profitable branch of husbandry, than it began to spread from the sea-shores into the interior, but a great difficulty then arose from the adhesion of the fibres to the hairy green seed, which was not overcome till Whitney and Miller's saw-gin became known. The hairy cotton, the second of the four varieties, had obtained the preference over the others upon the inland grounds of Georgia and Carolina, because the wool, though shorter in the staple, was much stronger, and came to maturity at an earlier period in the autumn. The simple roller gin, which answered well to separate the long staple from the black seed, was quite ineffective for the short staple, because the fur upon its seed stuck to the rollers and obstructed the entrance of the proper textile filaments. But wherever Whitney's machine became known it was laid hold of with avidity, and with little regard to the patent privilege of the inventor. Whitney's saw-gin was first mounted on a good scale at Mr. Miller's plantation, sixteen miles above Savannah, in the year 1795. See fig. 11, p. 141.

* The green-seeded Georgian cotton is probably derived from the accidental crossing of the *hirsutum* and *herbaceum* species.

This gin acts perhaps a little too roughly on the fibres, tearing a few, and causing a loss of about one-sixth of the wool when compared in its product to that of the roller gin applied to the Sea-island seed cotton. The power of the saw-gin is, however, so great as to give it a preference, since one machine of ten pounds value can clean a whole bale of cotton daily by the work of a single horse.

Henceforth the short stapled cotton began to be grown in all directions round Georgia as a common centre; north into the two Carolinas, west into the hill country, and into all the southern states, accommodating itself to the different soils and climates of the interior, which the Anguilla cotton would not do. It may be remarked, however, that the short stapled wool is of a better quality when raised near the sea than at a great distance from it; and it thrives most luxuriantly in alluvial soils, a little impregnated with salt, as in some of the districts of Louisiana. There the soils, which are deeply tinged with red, and well seasoned with salt, between the waters of the Arkansa and the Red River, give forth the most abundant crops of the best quality of that description of cotton. From the information of intelligent cotton farmers, Mr. Spalding states, that a thousand pounds of seed-cotton or two hundred and fifty of ginned wool may be raised with reasonable diligence from an English acre of land in that district; whereas, in the hill country from the Mississippi to the Carolinas, not more than five hundred pounds of seed-cotton can be obtained.

The system of agriculture throughout all these districts is essentially the same; the hand hoe used exclusively on the sea-coast being replaced by the plough

in tilling the ground of the interior. The plough breaks up the soil more thoroughly than the hoe, and does eight acres at the same expense as four can be done by the hand instrument; but both are employed in the method of ridge husbandry. The distance between the ridges is five feet, and that between the plants in the furrows varies from six to twenty-four inches, according to the circumstances formerly mentioned. As the winds of autumn are much less violent in the interior than upon the sea-coast of Georgia and Carolina, and as the capsules that contain the short staple expand much less in ripening than those of the Sea-island, the upland cotton harvest is much less precarious than the other, less of its cotton is lost by the capsules falling off spontaneously, and less trouble is occasioned in plucking the shrubs. In fact the short stapled pods are allowed to hang upon the plants till they are white with the wool, so that they may be reaped at two or three gatherings, instead of ten or twelve employed in the Sea-islands, and therefore at not more than half the cost of labour.

Several varieties of this kind of cotton grow well and perfect their fruit all the way from the southern borders of Virginia to the south-western streams of the Mississippi, over a length of twelve hundred miles, with a depth of two hundred miles inland; and in every soil, whether clay, loam, or sand, provided the waters be kept well drained from the surface of the land. The mean quantity over all is given by Mr. Spalding at one hundred and twenty-five pounds of both Sea-island cotton wool, and of the short stapled wool, to an English acre, but the amount of labour is much greater for the former than for the latter. Cotton does not

exhaust the ground, but from the density of its shade, and the size and swelling of its roots, it soon makes the soil too loose to sustain the plant; and, if cultivated continually on the same land, the plant becomes affected with a disease greatly resembling the blight in wheat, and gives birth to seeds which have a propensity to extend the evil. Mr. Spalding ascribes this disease to an insect puncturing the shrub, followed by a parasitic plant, and recommends fire as the best remedy for ground so affected: all the weeds and grass on the land should therefore be burned.

"There is no plant which requires rotation of crops more than the cotton, and there is no country where that practice is more important than in the southern states. The cotton fields should therefore be reaped with an intermediate crop of grain, and all root crops should be avoided. This simple triennial course, with manure applied during the grain year to as great an extent as may be convenient, will preserve the fields from any material decay."

In conclusion we may state that eight acres cultivated by the plough will yield the farmers annually, on a fair average of seasons, one thousand pounds of short stapled cotton wool to each labourer employed upon them. Their cotton has paid them about ten cents a pound during the last seven years, or one hundred dollars for each mean year's work. There are exceptions undoubtedly to this estimate, for a few men have received much higher prices, particularly for Sea-island cotton, and a few also have raised a much larger quantity than 125 pounds to the acre, "but exceptions," says Mr. Spalding, "can never serve as a guide in conclusions as to either the wealth or productiveness

of a whole country. The besetting sin of agricultural statements is their exaggerations."

Mr. Seabrook states, in a letter accompanying his memoir, that it contains no assertions which are not historical, or which could not be substantiated by living testimony, and he says he makes this observation because considerable obscurity and doubt have hitherto existed with regard to the first introduction of Sea-island cotton into the United States. In an explanatory communication from Mr. Vander Hurst, it is said that "the exportation from South Carolina in 1795 must have been 1,109,653 pounds of cotton instead of £1,109,653 sterling worth.

The terms "Mains, and Santees" he defines as follows:—*Mains* means the black seeded, or long stapled cotton raised on the main land behind the Sea-islands; *Santees*, the cotton raised in the vicinity of Santee river in Carolina; but there is no original difference in the seed, which is black in both. He thinks a light sand to be the best soil for the Sea-island cotton plant. The finest seed is not always coated with fur, but it has invariably, at one or both ends, a small tuft or beard. The produce of this sort now brings in the Charlestown market from forty cents to one hundred cents per pound, and is procured by a judicious selection of seed from the general bulk, sufficient for a nursery, from which the quantity requisite for the entire crop is supplied; but this cotton from the nursery is "the extra fine," and commands the highest price. The word "hill" is incorrect, and is properly understood only by practical planters; for there is no hill: on the contrary, it is a hole into which the seed is thrown, made on the top of

the bed or ridge. A planter's acre is 210 feet square, divided for the apportioning of labour into four square parts called "tasks," 105 feet square each, and two tasks generally make a day's work for an able hand; it cannot consequently be 210 feet square, but 210 by 105 feet only. This error of Mr. Seabrook must have arisen from inadvertency, and should be corrected. The drawings of the black seed or long staple, and the green seed or short staple cotton plant, are a contribution from Dr. Capus, from which it will be seen that the leaves of the former have five lobes, agreeably to the botanical description of the *arboreum* species.

Mr. Seabrook considers cotton plants to be the spontaneous production of all the tropical regions of Asia, Africa, and America. A few of the planters of the State of Georgia began to raise cotton as an article of export soon after the peace of 1783. Indeed the first provincial congress of South Carolina, held in January 1775, had recommended the inhabitants to raise cotton, yet little attention was paid to that judicious counsel. Ramsay, in his "History of South Carolina," says that cotton was exported from that state in 1795, to the value of £1,109,653, a statement already remarked upon as erroneous.

The long staple cotton is thought by many to be the *Gossypium Barbadense* of the West Indies. But this has a shrubby stalk four or five feet high, tri-lobed leaves, with flowers consisting of several large yellow petals, each stained at the bottom with a purple spot. The capsule or pod when ripe opens into three partitions, in each of which is a lock of white cotton, investing the seeds.

The above three distinct varieties of long stapled cot-

ton, *Sea-islands, Mains,* and *Santees,* are worth respectively at this time, in the Charlestown, market, thirty, twenty-five, and twenty cents. Each of these varieties may be subdivided into several others, which are in general distinguishable only by the seeds and the quality of the cotton. The seed of the first variety is covered entirely with *green* fur, and has a beard of that colour at one of its ends or at both.

The seed of common Sea-islands, like that of Mains and Santees, is a pure black, and sometimes it is covered wholly or partially with white fur. In 1785 the late Governor Tatnall received, as Mr. Spalding stated above, a parcel of seed of the silky or Sea-island cotton, which came from Anguilla through the Bahamas. In that year and the one following, the seed of long staple cotton, and probably that of Mains and Santees, was also brought into Georgia from Pernambuco and the Bahamas: *Sea-island* cotton was not extensively raised in South Carolina till 1799; but as early as 1789 about twenty persons cultivated it in Georgia. It is not known whence the seed originally came. Before its cultivation in the United States the cotton which commanded the highest price in England came from the island of Bourbon. In 1786 Bourbon cotton sold at from seven shillings and sixpence to ten shillings per pound. In 1799 Sea-island obtained in Liverpool from five shillings to five shillings and three pence per pound, and the cotton of Pernambuco four shillings and sixpence. The genuine cinnamon and mango trees were introduced into the West Indies from Bourbon in 1782, and some other productions at a still earlier period. May not the seed of the Sea-island cotton have been also received from the isle of Bourbon, as well as the sugar cane? and may not the Bourbon

planters have got the seed of their highly-prized cotton from Persia, since it is now known that the Persian cotton is nowise inferior to the Sea-island except in point of strength.

The cultivation of this valuable shrub extends about forty-five miles from the sea shore in the States, and its fruit diminishes in all its valuable properties in proportion to its distance from the atmosphere of the ocean. The finest and best cotton now raised in the world is produced on the islands of Edisto, John's, Wadmalan, and St. Helena, in South Carolina. There are three methods of sowing the seed; viz., in long hills, in short hills, and in shallow trenches extending the whole length of the ridge. Long hills (by which is meant a row of holes two or three times the length of the hoe apart) are generally preferred in very rich land, where it is necessary that the plants should be far from each other. Of the three methods, that of short hills (or near holes, the width of a hoe apart) has been found to be the most useful as well as profitable. The quantity of seed sown to an acre is about half a bushel. The operation of hoeing is begun the last of April, and is conducted as follows:

The tops of the beds are first clean hand-picked, then 210 feet square are afterwards hoed by each slave, and every bunch of grass is carefully collected. The earth about the plants is also well scratched and loosened with the fingers. At the second working the usual practice is to haul, or draw, the earth directly from the centre of the alley (hollow) to within a few inches of the top of the bed. This is seldom done, however, when the cotton is very low, when the earth is too wet, or when it is too lumpy. If none of these

circumstances prevent, the planter either hauls twice in succession, *viz.*, at the second and third workings, or he hoes and hauls alternately. The number of workings which the crop receives seldom exceeds five or six; the last being usually given about the first week of July.

The proper thinning of cotton requires much judgment and experience. At the first hoeing, if the plants are very thick set, a few may be advantageously taken out. At the second working they are separated about two inches, where the seed has been drilled or reduced from six to eight stalks in a hill (hole); if short or long hills are used, when the period arrives for a third thinning, which is about the eighth day after the second, as the bark of the cotton stem is then sufficiently thick to bear exposure, the plants ought to be thinned six or eight inches apart, or from two to four in a hill. About a week or ten days after this, a few of the most intelligent labourers are employed to separate the stalks a little further. By the 25th of June the thinning of the crop is completed. In general, the cotton plants which grow about three feet high are left to the number of from 120 to 140 stalks in a task row (105 feet long); when they grow four feet high, to the number of 110; and, six feet high, to the number of sixty or eighty stalks.

The plough is very generally used in the cultivation of the *suntees*, for making the cotton beds, which are commonly about four feet apart. It is sometimes had recourse to also for breaking up stiff lands. The number of acres planted to each hand (labourer) is from four and a half to five and a half. A good crop is 130 pounds of ginned cotton from an acre.

The gathering of the crop commences about the 20th of August, and ends about the 1st of December. From thirty to sixty pounds per labourer are usually picked in a day.

The leaf and pod of long-stapled cotton are much smaller than those of the short-stapled; the pod of the former opens into three partitions, that of the latter into five. Upland cotton may remain unpicked on the plants for weeks, or perhaps months, without injury; but the long-stapled cotton unless picked very soon after its flower blows, falls from the pod and is spoiled. Exposure to the weather renders it brittle and colourless.

Any vegetable matter is a good manure for cotton, but it must be applied judiciously. Excess of food produces a large and luxuriant stalk, but renders the fruit scanty. For high and loose sandy soils, salt mud and green marsh grass or rushes are now commonly put under the sward on which the bed is to be made several weeks or months before seed-time. For low close lands, fresh cotton seed, pine straw, marsh rushes, corn stalks, or any substance rotted in the cow-house, may be used. The quantity of manure to an acre is as follows:—of salt mud from ten to twenty cart loads; cotton seed, about forty bushels; from the cow-house, from twenty to twenty-five card-loads; green sward or rushes, a layer of about four or five inches thick and ten inches in width.

There is perhaps no plant more delicate than Sea-island cotton. Being deep rooted, it is injured by rain, especially in the month of August. It is easily blasted by wind, or by a very slight frost. When young the leaves and roots are liable to be injured by

a small bug, and the whole plant to be cut down by the grub or caterpillar. Should June prove a wet month, a visit from the caterpillar towards the end of August will certainly take place. The depredations of this insect are almost incredible. In one week it has been known to destroy completely fields containing more than 100 acres. It is however seldom known to commit ravages on the main land.

On the Mississippi the growers of cotton think that new land does not produce so fine a quality of cotton as that which has previously borne two crops of grain. In preparing the ground they use the plough alone, and lay off the rows from four to six feet, and where the soil is as rich as the low grounds of the Mississippi even eight feet is not too much. They open the ridges by running a narrow drill with the plough, sowing the seed in it as they would grain, and covering it lightly with the harrow. The only art in making a good crop of cotton consists in not suffering even a blade of grass to grow among the plants till they are fully ripe, and not to crowd them too much together, that is nearer than ten or twelve inches from each other. From the 1st of September the pods, called there boles, begin to mature and open successively until winter has stopped the vegetation of the shrub.

As soon as the boles are completely opened, the cotton, which then hangs partially out of the shells, and has become almost dry, must be gathered by hand; care must be taken by the picker to lay hold with his fingers of the several locks of cotton only, so as to remove the whole at once, without breaking off any of the dry leaves about the bole; and if any fall upon the

cotton before the picker has secured his handful in the bag which hangs at his side, they must be carefully separated. It is necessary to use a bag with a close mouth to gather the cotton, for the plants have commonly many decayed leaves upon them which are easily shaken down; and these leaves greatly depreciate the value of the cotton among spinners.

"The saw-gin of sixty wraggs or saws ought not to make more than from 600 to 800 pounds of clean cotton in twelve hours; for when forced to run faster the cotton is not so clean, and its fibres are liable to be cut and torn."

Some writers on cotton husbandry have remarked that the red soil of the interior of Georgia is apt to give a tinge to the wool grown upon it, and that the gray soil produces a fairer cotton.

The seed, when sold for fodder, fetches about a dollar the thirty or forty bushels. The cattle are very fond of it, but unless it be mixed with dry fodder, such as the husks and leaves of maize, in order to dilute it, and prevent the cotton fibres from balling in the stomach, it has a scouring effect, and is reckoned unwholesome. Cattle grazed on the saline meadows of Florida and Georgia are subject to a fatal disease called the salt sickness. Mr. Couper has discovered that wood ashes mixed with their food is a certain cure, probably by neutralizing the muriatic acid disengaged from the sea-salt in the animal system.*

One of the finest samples of Sea-island cotton which I have ever seen was sent me by D. B. Warden, Esq., ex-consul of the United States, at Paris, and forwarded

* Silliman's Journal, vol. ix., p. 22.

to him for this work by Dr. Wardeman of Charleston. It was grown on the plantation of Mr. Benjamin Freeman, situated on Wadmalan Island, about twenty miles from Charleston. This cotton was discovered about five or six years ago, and the first sent to the market sold for 6 dollars and 75 cents the pound, while the ordinary Sea-island brought only about 30 cents. The growing of this cotton was for some time kept a secret, and even in 1831, when Dr. Wardeman visited Wadmalan Island, the fields in which it was grown were guarded during harvest time to prevent the stealing of the seed, three quarts of which were sold as a favour for 150 dollars.

The plant differs from the ordinary Sea-island shrub in having longer "limbs," (primary branches,) longer "joints," (secondary branches,) in the flowers being larger, of a brighter yellow, and the hairs of the pod being longer. It is by the latter mark that the best plants are recognised, from which the seed is selected for sowing the ensuing crop. Unless this selection be carefully made, the cotton will deteriorate every year, probably from the pollen of the common Sea-island getting upon the pistils of the superior kind, as the former abounds all round about. The pod opens into three triangular portions, disclosing cotton of a remarkably pure white; the plant of this fine cotton does not bear so luxuriantly as the common Sea-island; it is from three to four feet high, and is distinguishable by tufted seeds of a greenish colour, resembling somewhat those of the short-stapled cotton of the inland country.

I have been told by an eminent cotton spinner in Alsace that the top flowers of the cotton plant afford the finest seeds, and are selected by the most skilful

planters of the Sea-island district for improving the staple from year to year.

The cultivation of cotton upon the coast of Guiana has been conducted with much judgment and success. Here the land is an alluvial mud, thrown up by the great rivers that empty themselves into the ocean in its immediate neighbourhood. Land is daily formed by these deposits. The elevation above the level of the sea is so inconsiderable as to render inundations not uncommon, and the whole country is intersected by ditches, without which husbandry would be impracticable. For this reason, the land on which the cotton shrub is to be planted must be formed into beds about thirty-six feet wide, and surrounded by drains that cross the estate, and empty themselves into the trenches which run parallel with its length; these beds are slightly elevated towards the middle, with the soil turned out of the drains, so as to throw off the redundant moisture more readily, and prevent that stagnation of water round the roots of the cotton, so injurious to its growth. The land thus prepared is divided into portions of about five feet square. Small holes, four or five inches deep, and six or eight wide, are dug with a hoe, a little light earth is scraped into each hole, a small handful of seed laid on it, and it is covered over with mould. If the weather be showery the seed will spring up in three or four days. As soon as the plants are three or four inches high, they ought to be all pulled up by the hand, except three or four to each hole; this is generally done within a month after the first planting. About the same time the ground requires a first weeding, which is repeated every month until the trees are fully grown. At the second or third

weeding one stalk only is left in each hole, and then if it be eighteen inches or two feet high, the tops are nipped off to make the shrub throw out a sufficient number of lateral shoots. The usual period of planting cotton in Dutch Guiana is during the months of December, January, April and May. If it be planted in the first two months, which is the preferable season, the shrub will require to be pruned in June to prevent its growing too high; this is done when it attains a height of about three feet above the ground, while at the same time all the shoots from the stem higher than one foot above the ground are lopped off. But if the cotton be planted in April and May, the branches will require to be nipped only twice with the finger, and the plant will generally yield some cotton before Christmas, even in October, if the weather be dry; in general, however, the cotton plant of Guiana rarely produces a full crop before it has attained its second year, its whole duration being usually estimated at four or five years. Whenever a tree fails another is planted in its place, which practice is called *supplying* a field of cotton, and is particularly attended to at the period of weeding; the cotton-trees after they are one year old are regularly pruned annually, between the months of April and July.

In ordinary seasons the crop in Guiana is generally finished in April, and if the season be mild, May is the fittest month for pruning, a labour which generally employs the gang of negroes for about a month. After this period the utmost care should be had to keep the ground clear of grass and weeds, which grow very luxuriantly at that season; if the weather be favourable the cotton begins to throw out abundance

of blossoms by the end of July or beginning of August; the pods form in succession, and generally begin to open in about six weeks thereafter. It rarely happens that picking is general before the end of October, and it continues all through December, making what is called the first crop. The short rainy season now begins, and during its continuance the trees vegetate with uncommon vigour, and begin to blossom. When the weather is mild the second crop should commence by the end of February, and continue till the middle of April; the rains in general render this crop very unproductive.

As salt is considered to promote the growth of cotton, the old lands in Guiana are frequently inundated with salt water; this fact corresponds with the well-known circumstance that Sea-island cotton is superior to every other species.

After the cotton has been picked, it is dried in the sun until the seed becomes quite hard, for otherwise it would heat and swell; it is exposed for about three days, upon tiles or a wooden platform, to the sun; the seed is then separated by the simple roller gin, consisting of two slender cylinders made to revolve by a treadle moved by the labourer's foot, like a turning-lathe; a Guiana workman can gin from fifty to sixty pounds a-day with this very simple machine. The ginned cotton is picked by women in order to free it from broken seeds, dried leaves, or yellow flocks of cotton; a clever hand will clean from twenty-five to thirty pounds daily; the cotton is now packed in bags, and compressed by a screw into compact bales for exportation.

The cotton plant of Guiana is particularly subject

to the attack of an insect which has received the general name of *chenille,* or cotton caterpillar, an animal about an inch or an inch and a half in length; it is a species of phalæna. One of the most singular circumstances attending the ravages of this insect is the fragrant smell which issues from the plant it feeds upon, although neither the animal nor the healthy plant possesses any odour; so powerful is this smell that it may be recognised more than a hundred yards from the plant.

The rapidity with which this caterpillar carries its ravages to distinct and even remote plantations is surprising; in the course of a single night whole fields, containing several acres, have been devoured by them. Hitherto the only sure defence against this destructive enemy is found in keeping the intermediate space between the cotton shrubs free from every species of vegetation on which the caterpillar can feed; children are also employed in picking them off the shrubs.

Cotton plantations are liable also to another calamity, called the blight; its tendency is to check or destroy the vegetative powers of the plant, and to deprive it of every productive faculty for a season. No satisfactory explanation or remedy for this evil has hitherto been offered.

A species of scarabé, the *apate monachus,* is a third enemy of the cotton plant. The larva of this insect begins its attack by boring a hole in the green bark of the cotton-tree, it penetrates into the alburnum, eats it with a revolving motion under the bark, and proceeds then to the wood and pith; the branches thus attacked dry up and perish. When a new-made hole is perceived upon a tree it should be closed carefully

with wax, which, by excluding the air, soon causes the insect to die, and saves the tree. The dead branches should be cut off and burned.

There are, moreover, red and black bugs, which sometimes suck the seeds of the cotton plant at the period when the capsules open. When seeds so gnawed get accidentally between the rollers of the cotton gin, they are crushed flat, and cause the wool to be soiled with the animal impurities of the bug.

At Pernambuco the cotton shrub is triennial; it affords a little wool the first year, more the second, and after the third crop it is abandoned, and replaced in the land by farinaceous plants, such as tapioca. The Brazil cotton is also triennial plant.

According to Forbes, the rice and cotton fields yield a double crop in Guzerat, and they are both planted at the commencement of the rainy season, in June. The rice is sown in furrows, and reaped in about three months; the cotton shrubs, which grow to the height of three or four feet, and in verdure resemble currant bushes, require a longer time to bring their delicate fruit to perfection. They are planted between the rows of rice, but do not prevent its growth or impede its being reaped. Soon after the rice harvest is over the cotton bushes put forth a beautiful yellow flower, with a crimson eye in each petal; this is succeeded by a green pod filled with a white stringy pulp; the pod turns brown and hard as it ripens, and then separates into two or three divisions containing the cotton. A luxuriant field, exhibiting at once the expanding blossom, the bursting capsule, and the snowy flakes of ripe cotton, is one of the most beautiful objects in the agriculture of Hindostan. Herodotus says, the In-

dians in his time possessed a kind of plant, which, instead of fruit, produced wool of a finer and better quality than that of sheep, of which the natives made their clothes.—*Oriental Memoirs*, vol. ii. p. 407.

Whoever has been in India, says Dr. Willick, must have found that the ryot, or farmer, will never exert himself beyond what will give him his daily food. To this state of things it is owing, for one instance, that the cotton plant is almost always reared as an annual in India, whereas in America (Guiana and Brazil) and the Leeward Islands it is triennial. He believes that India produces of itself every variety of cotton. It is his opinion, that the justly celebrated American Sea-island cotton is actually in cultivation in several parts of India, but owing to the manner of husbandry among the natives, it very soon loses all its principal characters for goodness, and returns to the quality of the original wild species. That miserable husbandry, adds he, which never allows the plant to outlive a season, if it remained even on the sea coast, would be quite sufficient to deteriorate any cotton.* Among the thousands of Indian plantations, one can hardly be found of a perennial kind. In the cleaning, conveying to the sea ports, and final packing for export of Indian cotton, there are great imperfections. The extreme badness of the boat, or ugly floating mass of wood called a *patella*, in which the cotton is sent to the general place of shipment, greatly injures its quality. Huge cotton bales are piled upon it, one over another, with little protection, during a voyage of four or five

* Dr. Willick does not seem to be aware that all the cotton of the Southern States of the American Union is the growth of annual plants.

months, from the rains so abundant at the season of conveyance, to Calcutta. Here they arrive in a very filthy state, and are then subjected to the action of bad screw presses, very irregularly worked, sometimes by the power of twenty men and sometimes by that of fifty. Thus the seeds get incorporated with the damp cotton and give out their oil, so as to discolour the cotton, and render it liable to rancidity and mouldiness.

Between the cleaned Bombay cottons, and the best cleaned American upland cottons, there is a very considerable difference of value in favour of the latter. The improvement required in Indian cotton is the introduction of a different seed to which the wool would adhere less strongly, a more frequent change of seed, much greater attention to the cultivation, and care in cleaning, drying, and packing. It ought to be sown in drills and not broad-cast. The cotton plant at Bombay is generally an annual with short-stapled wool and green seeds. It is never cleaned with the saw-gin, though, being coarse, strong, and adhesive to the seed, it would require it. The East India Company never took any measures of consequence to improve the cottons; and no lands producing the cotton plant are in the hands of Europeans.

In the eastern, as well as in the western hemisphere, the influence of the sea coast on the growth of cotton seems equally propitious. Dr. Willick brought home several samples of cotton from the coast of Martaban to the India House, which were grown near the sea. They were not exceeded by the cotton of any other country in the quality of the staple, or the facility of its separation from the seed. There is a village near

Mangrole in Kattywar, which produces a small quantity of very fine cotton. It is cultivated by natives, and grows only on one particular spot of small extent near the sea coast.

Cotton from the Bourbon seed is grown in India only near the sea; when transplanted to Benares, which is 400 or 500 miles inland, the crop entirely failed.

The Dacca cotton, from which the finest Indian muslins are made, is in small quantity, and all consumed in that district. It is quite unknown at Calcutta. The finest of the Chinese cotton is likewise produced near the sea.

Two species of cotton, in particular, are cultivated in the islands of the Indian Archipelago, which Mr. Crawford calls the *gossypium herbaceum* and *gossypium arboreum*, probably more in reference to their size, than to their true botanical characters. It is remarkable that Java, the most fertile and improved country of that region, should produce the worst native cottons. When the cotton shrub is grown in succession to rice, it yields only one crop, and then perishes from submersion during the rains. On such marshy lands, the cotton plant cannot thrive. The seed in the common cotton of Java is to the wool in the proportion of four to one by weight, and adheres much more strongly to the fibres than the black seed. One person can clean no more cotton wool from this seed than a pound and a quarter a-day.

Having detailed the most approved methods of cultivating cotton, I shall next describe the means by which it is prepared for the market. The first step, the separation of the wool from the seeds, is effected

by the gin or ginning machine, which is of two kinds, the simple roller-gin, fig. 10, and the saw-gin figs. 11 and 12.

The roller-gin, as above described by Mr. Spalding, consists of fluted rollers five-eighths of an inch in diameter, and from nine to sixteen inches long, placed parallelly in a frame which keeps them almost in contact. Were the rollers thicker or farther apart, they would crush the seeds, or draw them through with the cotton wool; whereas they are so adjusted as to pull through the fibres and exclude the seeds. With one of these little machines, a stout man can clean from thirty to forty pounds of the black seeded cotton in a day, but the labour is extremely hard. A pair of such small fluted rollers has been used in India for this purpose from an ancient period. It is worked by hand, without the advantage of the treadle and fly wheel.

In 1820, Mr. Harvie of Berbice, obtained a patent for an improvement on the roller-gin, which consisted in the application of a thin long brush to the posterior surface of the rollers, with the view of preventing the cotton from being carried round about with them, an accident apt to injure its colour and staple. This brush may be adjusted by screws attached to the roller-frame, whereby its bristles may be brought to bear with any desired force against the rollers.

It is said that the rollers are liable to get very hot during their rapid rotation, to obviate which, it has been proposed to make them hollow for the free passage of cool air, or even water. For this contrivance a patent has been obtained in the United States.

This machine has been occasionally driven by horse

power in Guiana; but the casual ties arising in the progress of ginning cotton, have led to the preference of human labour. When dexterously managed it performs the business of cleaning cotton in a very perfect manner, without injuring the staple. The principal objection to it is the small quantity of cotton which it can clean in a day. This is obviated in some measure by restricting its use to the Sea-island and other fine-stapled or black-seeded cottons.

Travellers from Senegal, report that the roller-gins sent from Paris thither turned off only four pounds of cotton a-day; and their labour cost 12 sous per pound of cotton, an expense which absorbed all the profits of the planter. The cause of this trifling product of the machine may be readily conceived. As the cylinders possess no elasticity, and as they must close evenly together to seize the cotton wool, if they are made from awkwardness to draw in a little more at any one point, they are thereby forced asunder, and become ineffective through the rest of their length.

The coarser and stronger stapled cotton of Upland Georgia was originally cleaned by the vibrating stroke of the bowstring, the cord being raised by hand and suddenly made to recoil upon the seed-cotton. The force of this impulsion separated the seeds, and opened up the wool. From this practice, this cotton was called bowed Georgia. The bowstring is also one of the ancient implements used by the Hindoos and Chinese for cleaning cotton wool. See fig. 2, p. 42.

Till Mr. Eli Whitney invented his saw-gin in 1793, the wool of the green-seeded cotton could not be separated from the seed, unless with a degree of labour very discouraging to the growth of that hardy and

productive article. But since that era, this branch of husbandry has become of paramount importance to the southern states of the American union. Having spent a winter in completing his machine, Mr. Whitney showed a few friends that it could separate more cotton from the seed in one day by the labour of one man, than could be done by the existing methods in a month. The construction of this instrument was an event of such consequence as to excite an universal interest in the state of Georgia, where Mr. Whitney then lived in narrow circumstances, under the roof of a hospitable friend. Neither the sentiments of justice nor the fear of the law, could restrain the eager crowds from breaking into his workshop by night, and carrying off his wonder-working tool. In this dishonourable way the public acquired possession of Mr. Whitney's invention before the model was finished to his mind, and before he could secure the protection of a patent. Many copies were immediately made from it with slight variations, in order to evade the patent, which he obtained soon thereafter.

Thus the inventor of a most ingenious machine was not suffered to reap in peace a reasonable share of the fruits of his labours, which proved so beneficial to his country. He was tormented with the most vexatious litigations, and though he was soon supported by a partner possessed of some capital, he was in a few years well nigh ruined. At length, in the year 1801 the legislature of South Carolina purchased from Mr. Whitney a patent license for that State for the sum of 5,000 dollars. Next year he disposed of a license to the State of North Carolina, the legislature of which laid a tax for five years, of 2*s*. 6*d*. upon every saw in every

gin that was mounted within their jurisdiction. Some of these gins contained no fewer than forty saws. This tax was collected, along with the public imposts, by the sheriffs, and after the expenses of collection were deducted, the balance was faithfully paid over into the hands of the patentee. No small portion of the funds thus honourably raised in the two Carolinas, was expended in carrying on fruitless law-suits against the piratical invaders of his privilege in the state of Georgia. "There have indeed," says the American biographer, "been but few instances where the author of such inestimable advantages to a whole country as those which accrued from the invention of the saw-gin to the southern states, was so harshly treated and so inadequately compensated as Mr. Whitney. He did not exaggerate when he said, that it raised the value of these States from 50 to 100 per cent." "If we should assert," said Judge Johnson, "that the benefits of this invention exceed 100,000,000 dollars, we can prove the assertion by correct calculation."

Whitney had to vindicate not merely his pecuniary rights, but his character; for attempts were made, as is usual in such cases, to deprive him of the honour of the invention. In 1812 he applied to Congress for a renewal of his patent, representing that he had been tormented with litigation for eleven years before his rights were legally recognised, and that thirteen years out of the fourteen of his privilege had expired with very little advantage to himself, but very beneficially to the nation; "for his invention had enabled one man to do the work of one thousand." The planters of the southern states so warmly opposed Mr. Whitney's application, that it failed of success. Meanwhile this

ingenious man, when he found his hopes blasted of reaping the fair reward of his saw-gin, betook himself to the manufacture of fire-arms, and executed several contracts for supplying the United States' service with them. Thus the implements of human destruction enabled him to realize that competency which one of the most powerful tools of peaceful industry had failed to procure.

The saw-gin consists of a wooden cylinder about the size of a weaver's beam, furnished with a series of circular saws, fixed on it at regular distances perpendicular to its axis. The machine in its original state had merely projecting wire teeth, with which it was apt to tear the filaments into a short nap; it was thereafter mounted with circular plates of iron serrated at the edges. These serve to pull the filaments through a wire grating, the divisions of which are too narrow to permit the seeds to pass. Though very expeditious in its performance, and not essentially injurious to ordinary cotton staple, it would be apt to tear the long and delicate filaments of Sea-island cotton. One saw-gin can clean about three hundred weight of cotton in a day. The common roller-gin has been occasionally made to clean the Upland Georgian, but it does not answer so well as the saw-gin in clearing away the seeds and opening up the wool. The staple of Surat corresponds in some degree to that of the Upland Georgian, and should be cleaned with a similar machine, whereby it would fetch a better price in the market.

Description of the Saw-gin of Whitney.

The principal parts of the saw-gin are two cylinders of different diameters (see F, H, figs. 11 and 12) mounted

in a strong wooden frame, A, which are turned by means either of a handle or of a pulley and belt, acting upon the axis of a fly wheel attached to the end of the shaft opposite to that seen in the section, fig. 11. Its endless band turns a large pulley on the end D of the saw cylinder F, and a smaller pulley upon the end E of the brush cylinder H, fig. 12, so as to make the latter revolve with the greater rapidity. Upon the wooden cylinder F, ten inches in diameter, are mounted, three quarters of an inch apart, fifty, sixty, or even eighty circular saws, edged as at I, fig. 11, of one foot diameter, which fit very exactly into grooves cut one inch deep into the cylinder. Each saw consists of two segments of a circle, and is preferably made of hammered (not rolled) sheet iron; the teeth must be kept very sharp. Opposite to the interstices of the saws are flat bars of iron, which form a parallel grid of such a curvature that the shoulder of the slanting saw-tooth passes first and then the point. By this means, when a tooth gets bent by the seeds, it resets itself by rubbing against the grid bars instead of being torn off, as would happen did the apex of the saw-tooth enter first. Care must be taken that the saws revolve in the middle of their respective grid intervals, for if they rubbed against the bars they would tear the cotton filaments to pieces. The hollow cylinder H, is mounted with the brushes *c, c, c,* the tips of whose bristles ought to touch the saw-teeth, as at *d, d,* fig. 12, and thus sweep off the adhering cotton wool. The cylinder H, revolves in an opposite direction to the cylinder F, as is indicated by the arrows in fig. 11.

The seed cotton, as picked from the pods, is thrown into the hopper L, fig. 11; the disc-saws, I, in turning

round, encounter the cotton filaments resting against the grid, catch them with their sharp teeth, and drag them inwards and upwards, while the stripped seeds, too large to pass between the bars, fall through the bottom, N, of the hopper upon the inclined board M. The size of the aperture N is regulated at pleasure by an adjusting screw to suit the size of the particular species of seeds. The saw-teeth, filled with cotton wool, after returning through the grid, meet the brushes *c, c, c,* of the cylinder H, and deliver it up to them;

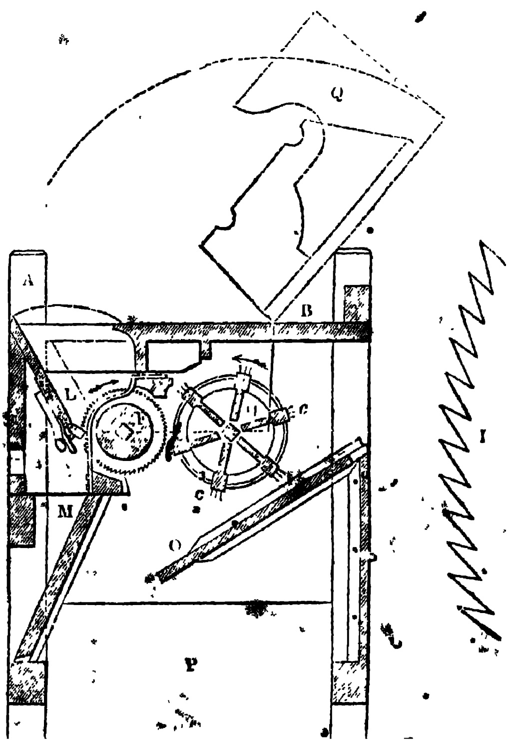

Fig. 11.—Section of Whitney's Saw-gin.

the cotton is thereafter whisked down upon the sloping table O, and thence falls into the receptacle P. A cover, Q, fig. 11, encloses both the cylinders and the hopper; this cover is turned up round its hinges, (as shown in fig. 11,) in order to introduce the charge of seed cotton into the machine, and is then let down before setting the wheels in geer with the driving power. The axes e, e, f, f, of these cylinders (fig. 12) should be well fitted into their plummer box-bearings, so as to prevent any lateral swagging, which would greatly injure their operation. The raised position of the cover is obvious in fig. 11, the hinge being placed at B. By means of the saw-gin one man, with the aid of a water-wheel possessing a two-horse power, can clean 5,000 pounds of seed cotton in a day, eighty saws being mounted upon his machine. The cleaned wool forms generally one-fourth of the weight of the seed cotton, and sometimes so much as twenty-seven per

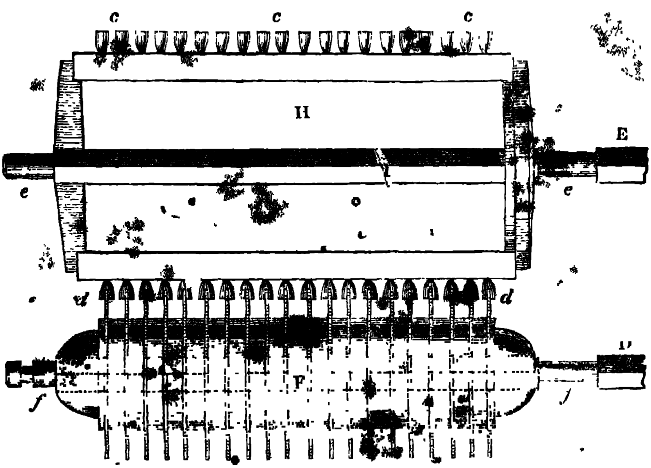

Fig. 12.—Plan of the Saw and Brush Cylinders of Whitney's Saw-gin.

cent. The ginners are usually a distinct body from the planters, and they receive for their work one-eighth or one-tenth of the net weight of the cleaned cotton, under an obligation to supply all the seed required by the planter. The owner furnishes the bags in which the cotton wool is packed at the mill.

Joseph Eubank, of Kentucky, has proposed to make the saw-gin still more automatic in its performance, by supplying the seed cotton not by hand, but by a feeding-apron, similar to what is employed in the cotton carding-machines. This apron is destined to carry forward the cotton at the proper rate towards the saw-teeth, where a roller set with iron wire fangs seizes the cotton, and throws it briskly against the saw-gin cylinder.

Cotton wool is now generally condensed into compact bales for facility of transport, by the aid of the hydraulic press; for which purpose a wooden case is built up, consisting of several square frames piled over each other, and then fastened together at the corners by moveable bolts. This chest frame has the same dimensions in its area as the base of the bale, but is of a height about four times greater than the bale, to admit a sufficient bulk of uncompressed cotton wool. The bottom is the sill-plate or board of the hydraulic press, and has grooves cut in it, into which the cords are laid; the top of the case touches the top plate of the press, and whenever that top plate enters a certain way into the case by the ascent of the hydraulic piston, the upper horizontal layer of the frame is removed by taking out its corner bolts. Presently another is withdrawn, and so on, till the desired condensation has been given to the cotton; the bale is now bound hard

by the cords, and then put into its bag. By this contrivance the cotton suffers such a degree of compression, that from five to six hundred weight of it may be packed into a bulk of twelve or thirteen cubic feet. This great condensability of cotton is very favourable to the manufacturers of Europe, rendering it transportable from America or India, at an expense too inconsiderable to affect the price of the finer cotton fabrics. The average gross weight of a bag of cotton from the United States varies from 330 to 350 pounds, of which seven pounds belong to the bag.

The freight in general of cotton wool from Georgia or Carolina to Liverpool varies from one halfpenny to seven eighths of one penny per pound; the freight of cotton from Madras to England is, upon an average, about 1*d*. per pound; for the freight of a ton, equivalent to four and a half bales, or to 50 cubic feet, is about £6, and the weight of the Madras bale is from two hundred and ninety-five pounds to three hundred. The freight of Egyptian cotton in a bale compressed by power is three farthings per pound, and seven eighths of a penny when the bale has been packed by manual labour; the weights of the Egyptian packages are very irregular, varying from 200 to 400 pounds.

There is no manufacturing district in Europe into which cotton wool can be imported from the several parts of the world where it is grown, at an easier rate than into Lancashire, Lanarkshire, and Renfrewshire.

Almost all the cotton wool consumed in the British manufactures was obtained from the West Indies and Guiana prior to the year 1794, with the exception of

a little from India and the Levant for the fustian trade, and a still smaller quantity from the Brazils and the Isle of Bourbon for the finer muslin yarns. The state of our cotton-wool markets in 1787 was the following:—

British West-Indian Cotton		6,800,000 lbs.
French and Spanish Colonial		6,000,000
Dutch	ditto	1,700,000
Portuguese	ditto	2,500,000
Isle of Bourbon		100,000
Smyrna and Turkey		5,700,000
		22,800,000

Messrs. George Holt and Co., the eminent cotton-brokers of Liverpool, give, in their printed statement, 25,600,000 pounds as the quantity annually imported into Great Britain from the years 1786 to 1790.

The American wool was at first ill cleaned, and was therefore deemed applicable only to the coarser fabrics; but a few skilful spinners soon recognised the excellence of the long-stapled Georgian wool, and eventually gave it a rank above that of the highly-prized Bourbon cotton. As the Upland cotton wool was much more difficult to clean from its seeds, it arrived in Great Britain in a still dirtier state than the other, and was therefore regarded for some time with distrust. But it also, at no distant date, surmounted every prejudice, and now constitutes the material of a large proportion of the cotton goods manufactured in Europe. In 1832 the cotton wool of the United States imported into Europe was 880,000 bales, and that imported from all other quarters was under 450,000; since which time the production of the States has been increased, while that of the other cotton

districts has been diminished. So long ago as the year 1807, considerably more than 35,000,000 pounds of cotton must have been raised in the interior of Georgia, for Upland wool to that amount was at that time exported from the United States.

During the war the rate of freight was 3½*d.* to 4*d.* a pound; from Amelia Island and other places it is now from a halfpenny to five-eighths of a penny, and sometimes a farthing, according to the greater or less distance of the port from whence imported. By the improved system of ship-building the shipowners are making money at those rates. An American ship was thought formerly to be a very superior vessel as to model if she carried 900 pounds to the ton of register, but they have so far improved within the last twelve years as to be able to store 2,000 pounds of cotton to a ton of register, owing partly to the compression of the bags, but chiefly to improvements in the model of the vessels. The above rate would not pay British ships upon the old form of ship-building, which is deep and very short, whereas the new ones are long as well as deep. The Liverpool ships of the new construction, however, can compete with the American. The risk, and consequently the insurance, is less on American ships manned with Temperance crews, than on British. More than half the whole import for the States comes now from the Gulf of Mexico, and it is on the increase.

According to Mr. Bates, the cost of transport of cotton from New Orleans to Boston, Providence, New York, and Philadelphia, is about half what it is to Liverpool. Also, in the building, equipment, and navigation, the American ships are more economically conducted than the English.

The Increase in the Growth of Co[illegible]on in the United States.

CO[illegible]N EXPORTED.

Years.	Bales of 300 lbs.	
1794	5,340	
1795	20,901	
1796	20,355	Nearly all the crops were exported in
1797	12,628	this period. In 1795 and 1796,
1798	31,200	some forei[illegible] cotton was included
1799	31,[illegible]74	in the returns o[illegible] exports.
1800	59,[illegible]	
1801	67,700	Slave population in 1790 . 697,000
1802	91,670	1800 . 896,[illegible]00
18[illegible]	137,018	
1804	[illegible]7,0[illegible]	
1805	[illegible]27,966	
1806	122,225	These are the quantiti[illegible] exported,
1807	213,148	and probably include nearly the
1808	35,434	whole growth, except during the
1809	169,934	years 1812 and 1814, the period of
1810	310,871	war between Great Britain and [illegible]
1811	206,860	United States.
18[illegible]	9[illegible],291	
1813	62,030	Slave popula[illegible]n in 1810, 1,191,000
1814	59,[illegible]94	
1815		
1816		
1817		
1818		These are accurate, and represent the
1819	303,589	entire crops.
1820	369,800	
1821	539,038	Slave population in 1820, 1,538,061
1822	588.139	
1823	[illegible]09,600	
1824	560,000	
1825	7[illegible]0,000	
18[illegible]	937,000	
1827	712,000	
1828	857,000	
1829	976,845	[illegible]ntire cr[illegible]
1830–1	1,038,847	Slave population in 1830, [illegible]2,010,4[illegible]
1831–2	987,477	
1832–3	1,07[illegible]438	
1833–4	1,205,394	
1834–5	1,254,328	

Given by Joshua Bates, Esq., to the Committee on Ma[illegible]factures.

The fall in the price of cotton wool has been owing to the extension of the growth of the cotton plant in the southern States of the Union, where the lands are more fit for it, and where it may be produced more cheaply. Hence the exports from New Orleans bear a much greater proportion to the exports from Charlestown and Carolina than they used to do. The freight of cotton from the southern States of the Union to the eastern or manufacturing States may be reckoned at five-eighths of a cent, including the insurance and other charges, as from New Orleans, or Mobile, to Boston. The saving in this particular to the American spinner is no less than a halfpenny per lb., which, on cotton worth sevenpence, is equivalent to seven per cent. upon its cost. The American manufacturer also saves the average profits paid by the British manufacturer to the class of middle-men, commonly called the "cotton importers." The duty in this country of five-sixteenths of a penny per lb. of cotton wool, becomes, under such circumstances, an oppressive impost upon its coarse goods.

It is greatly to be lamented that the parent soil of the cotton plant and of the cotton manufacture should have been suffered by its British masters to remain so long without improvement, or rather to become deteriorated in reference to this valuable article; and that, while the inhabitants of Georgia and Louisiana are deriving enormous benefits from this productive agriculture, the humble ryots of India should be kept in a state of poverty, to the reproach and loss of our nation, for want of suitable education and encouragement. Were the docile peasantry of Hindostan aided in their rural labours by British enterprise and intelligence, they might ere long create for themselves and for this

country an inexhaustible source of comfort and independence. How grossly mismanaged the cotton husbandry was by the residents of the East-India Company will appear from the fact that they made by order of Government a trial of the American saw-gin, the instrument best adapted to their short-stapled cotton, but without success. *The machinery ground up the seed with the cotton.** The Surat wool, upon which this awkward experiment was made, resembles very closely the Upland Georgian, and may undoubtedly be ginned by that machine, *rationally* applied. Mr. Ritchie stated, in his evidence before the Committee of the House of Commons, that the natives have no prejudice against any such machinery. Their own roller-gin costs 6*d.*; it is turned by hand, cleans the cotton very rudely and with great waste of labour; it takes little strength, indeed, but occupies the whole time of one person. The cotton must also be subsequently cleaned by a bowstring, which breaks it to pieces. "The attempts to improve the cotton have not succeeded. In some of the experiments the cotton deteriorated very much; in others the seeds did not come up well. There has been no improvement in cotton since the introduction of the free trade. It was better in 1818 and 1819 than it is now. The Company have taken very trifling measures, not worth mentioning, to improve it. There is no doubt that it would be improved by greater skill being employed in its cultivation. There is no reason in the world to suppose that the cultivation of India might not be improved."† In

* Ritchie—Commons' Report on Indian Affairs, 1830-31.

† Appendix to Report from Select Committee on E. I. Company, 1832. p. 468.

May, 1830, the Government published regulations to prevent the adulteration of cotton wool, and it has become comparatively clean, though there is no improvement in the cotton itself.* India is capable of producing cotton for the European market, provided there is a proper application of skill and capital to the production of the article, in the same manner as in other countries; but the unaided skill of the natives is incapable of doing it.

The portion of the cotton crop destined for the Company,† as the rent of land, is delivered by the planter to the collector in the state of seed cotton, being merely picked out of the pod. Surely this portion, amounting, on an average, to one-half of the whole crop, might be ginned by Whitney's machine if the business were administered with the most ordinary discretion, particularly as all the damaged and foul cotton is rejected. The commercial resident bargained usually for the remainder of the crop, and therefore, had he not been placed above the necessity of effort and ingenuity, he might have organized a system of saw-gin mills similar to the American.

When the rent of lands became payable in money in the other presidencies, as it had been in that of Bengal, the cotton husbandry was expected spontaneously to improve. We wonder only how, under the exaction and insolence of the fiscal system of seizing the produce for rent, Guzzerat could export 100,000 heavy bales per annum. We hope such a liberal policy will be pursued towards the ryots of Bengal as will enable

* Appendix to Report from Select Committee on E. I. Company, 1832, p. 468.

† Ibid.

them to improve their cotton husbandry, as also towards the planters of Bombay, whose abject wretchedness and ignorance are a disgrace to the British administration in that district of India.

Though the general use of cotton garments in ancient Egypt has been fully disproved by an examination of the mummy clothes, the successful cultivation of the plant in modern Egypt has been realized by its enterprising ruler, Mahmoud Pacha. The peculiar fitness of the soil and climate for rearing the *gossypium* had no sooner occurred to his mind than he commenced operations with equal vigour and sagacity, and, in the course of a couple of years from undertaking this new species of husbandry, he exported no less than 5,623 bales of cotton to England. The wool sent to this country is of superior quality, is all long-stapled, the growth of well-selected seed; one species being called Makò by the Egyptians, and common Egyptian by the English; another is named Sennaar in Egypt, and Sea-island Egyptian in England, as grown from Georgian Sea-island seed. The average export of cotton from Egypt may be estimated at from fifty to sixty thousand bales per annum. The best of it ranks in value next to the American Sea-island, and in general quality it is fully equal to the Guyana wool.

A few plants discovered accidentally in a garden of Makò-bey, at Cairo, suggested this profitable branch of agriculture, and gave the name of Makò cotton to the samples first sent to England in 1822. During every subsequent year it has formed an article of importation into this country, and has now acquired considerable importance in Europe.

Imports of Egyptian Cotton Wool.

	London.	Liverpool.	Glasgow.	Total in Great Britain.	Sale Price, 31st Dec.
	Bales	Bales	Bales.	Bales.	d.
In 1823	1,277	1,173	—	2,450	11½ per lb.
1824	10,645	22,622	580	33,807	10¾
1825	21,831	80,736	631	103,198	10½
1826	8,115	38,218	—	46,333	8
1827	4,988	14,426	2,310	21,728	8
1828	3,820	24,702	2,616	31,138	7¾
1829	1,980	22,425	—	24,405	6⅞
1830	700	11,019	1,865	13,584	9
1831	8,540	26,487	1,050	36,077	8½
1832	2,837	32,271	5,109	40,217	8¾

The freight from Alexandria to this country is about three farthings per pound. The Makò is a cotton compared by some spinners to the Brazil.

It appears, from the narratives of Clapperton and Landers, that cotton is grown very extensively all over Africa, and especially along the course of the Niger, for the purpose of forming articles of clothing to the natives. No details have yet been obtained concerning the husbandry of the plant, or the manipulations by which its wool is manufactured. The people of Eboe, and other districts near the mouths of the Niger, are clothed in Manchester cottons, which they get in barter for palm oil, ivory, and other native products. What a vast area exists in this quarter of the globe for reciprocity of trade to Great Britain, whence it may receive the raw materials, cotton, and dye drugs, in exchange for their multiform and many-coloured fabrics!

M. Dortoc, a few years ago, made experiments during several seasons upon the cultivation of the cotton plant in the department of the Gironde; but the Government of France, after laying out considerable sums of

money on the project, abandoned it as hopeless, according to the decision of the Committee of Agriculture of the Société d'Encouragement, to which it was referred.

For the following general abstract of the cotton wool trade in 1834-5, I am indebted to James Cook, Esq.—

40, *Mincing Lane, February* 6, 1835.

MY DEAR SIR,—I herewith forward a table of the imports of cotton into the continent for 1834, and the consumption of the United States is 200,000 bales. I reckon the consumption of all countries to be as follows, and in this I am confirmed by the opinion of a friend of mine well capable of judging. You are at liberty to give my name as the authority for this statement, if it answers your purpose to do so.

Great Britain	940,000 bales
France	270,000
Continent	220,000
	1,430,000
America	225,000
	1,655,000
China* (Exports from India) . .	200,000
Total . . .	1,855,000

I am, my dear Sir, yours very faithfully,

To Dr. Ure. JAMES COOK.

Estimate of the probable Growth of Cotton in the World, (exclusive of China,) from the principal Cotton Countries, for 1835-1836.

	Bags and bales of 340 lbs.
India	400,000
Brazils and the West Indies . .	200,000
America	1,300,000
Egypt	50,000
Levant	70,000
	2,020,000

* The consumption of cotton in China far exceeds this estimate; for their own growth, which is almost entirely manufactured by themselves into cotton fabrics, is of considerable importance.

Cotton—Great Britain and the Continent.

	IMPORTS.		STOCKS.	
	1833.	1834.	1833.	1834.
Great Britain ..	930,270	949,020	215,130	185,560
Hamburgh	22,700	45,188	1,985	4,500
Bremen	3,530	6,814	345	1,406
Amsterdam	7,915	13,532	1,290	1,418
Rotterdam	13,862	43,785	1,504	200
Antwerp	24,120	24,124	4,500	2,480
Havre.........	210,600	201,600	33,920	22,000
Bordeaux......	3,944	6,682	81	95
Marseilles	74,544	48,938	12,780	1,063
Genoa	13,960	15,900	2,077	1,467
Leghorn.......	1,200	1,950	None	None
Trieste	61,847	53,193	12,538	6,375
	1,368,492	1,410,726	286,150	226,564

	Bags.
On the 1st of January, 1835, the Stock of Cotton Wool, in the hands of Dealers and Spinners, was .	63,672
Taken out of the Ports for Consumption in the course of that year	937,616
Supply to the Trade during the year, 1835	1,001,288
Stock in the hands of Spinners and Dealers, 1st January, 1836	308,301
Actual Consumption during the year 1835	923,000*

* Burn's Commercial Glance.

Quantity of Cotton Wool imported into England and Scotland in the following Years.

	America.	Brazil, &c	East Indies.	West Indies.	Other Parts.	Total.
	lbs.	lbs	lbs	lbs.	lbs	lbs
1827	216,924,812	20,176,162	20,930,542	7,165,881	6,711,512	272,448,909
1828	151,752,289	29,113,279	32,187,901	5,893,800	8,783,373	227,760,642
1829	157,187,396	28,878,386	[illegible]4,857,800	4,640,454	7,203,365	222,767,411
1830	210,885,358	33,092,070	12,481,761	3,129,247	4,073,016	263,961,452
1831	219,333,628	31,763,412	25,805,153	2,[illegible]52,864	9,119,796	288,674,853
1832	219,756,753	20,114,483	35,178,625	2,099,841	9,682,823	286,832,526
1833	257,506,758	28,[illegible]4,19[illegible]	32,755,164	2,474,654	2,456,063	303,656,837
1834	269,203,075	19,370,708	32,920,865	2,519,529	2,861,248	326,875,425

Bags and Weight of Cotton Wool grown and Manufactured in the United States.

	Number of Bags	Average Weight of Bags	Total Weight	Cotton consumed.
		lbs	lbs.	lbs.
1826 to 1827	937,000	336	314,832,000	34,770,288
1827 to 1828	712,000	335½	238,520,000	40,418,803
1828 to 1829	857,744	342½	301,991,756	40,736,850
1829 to 1830	976,845	340½	332,371,511	42,845,708
1830 to 1831	1,038,848	312	368,08[illegible],796	62,[illegible]92,564
1831 to 1832	987,477	350¼	345,863,819	60,873,450
1832 to 1833	1,070,438	350	371,653,300	68,044,550
1833 to 1834	1,205,294	363¾	438,125,692	71,445,228
1834 to 1835	1,254,328	370	464,100,360	80,248,560

By the George Washington, which arrived at Liverpool on the 10th of February, 1836, advices from New York were received to the 10th of January, from which it appears that the quantity of cotton wool exported during the year 1835 amounted to 370,194,184 lbs., valued at the places of exportation at 61,435,746 dollars. Since 1792 the increase in the exportation from the United States has been nearly two thousand fold. In 1792 there were exported 138,328 lbs., the value of which was 32,000 dollars.

General Import of Cotton into Great Britain, from 1824 to 1835 inclusive; the Quantities taken for Export and Home Consumption, and the Stock remaining at the close of each Year, with the Prices Current of the principal Descriptions on the 1st of December.

IMPORT.	1824.	1825	1826.	1827.	1828	1829.	1830.	1831.	1832.	1833.	1834.	1835.
Of American	282,773	424,698	595,116	646,982	444,581	461,569	618,185	608,768	627,703	656,764	731,680	763,050
Brazil	142,559	198,431	55,742	120,056	165,240	159,808	192,267	170,234	114,665	161,537	103,570	113,580
West India	31,837	34,614	18,582	29,953	22,117	20,808	12,648	11,815	9,204	15,046	18,250	22,490
East India	50,846	69,502	64,698	74,546	84,795	80,522	35,212	76,614	109,086	95,058	88,490	118,680
Egyptian	33,745	103,112	47,362	21,908	32,855	24,712	13,596	37,719	40,320	2,569	7,030	42,370
Total No. of Packages	541,760	821,250	581,500	892,535	749,583	747,419	871,908	905,190	901,138	933,974	949,020	1,090,170
Exported	53,100	75,500	95,000	75,300	64,900	109,300	35,450	82,800	65,100	65,700	85,850	104,400
Taken for Home Consumption	639,100	565,430	559,660	707,500	731,030	754,660	805,580	867,850	865,990	897,680	892,740	941,320
Stock at the close of each year	235,360	415,660	342,500	452,250	415,900	280,390	320,260	274,800	245,120	215,870	185,560	230,010

CURRENT PRICES.	1824.	1825	1826.	1827.	1828	1829.	1830.	1831.	1832.	1833.	1834.	1835.
	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.
Bowed Georgia (duty paid)..	8¾ a 10½	6½ a 9½	6¼ a 7¼	5 a 6¼	5¼ a 7	5¼ a 7	6 a 7¾	4⅞ a 6¼	6½ 7¼	7½ 9½	9½ 11	7⅜ 11½
New Orleans .. " ...	10 12½	7½ 11	7 8¼	5½ 8¼	6 8	6 7¾	6½ 8	5½ 7½	6½ 8¼	8 10½	9⅛ 11½	7⅜ 12
Maranham.... " ..	10½ 11½	10½ 11½	9 9½	7½ 8¼	7¼ 7¾	6⅝ 7	7 7¾	6½ 7½	7½ 9	8¼ 10½	12 13¼	10 12½
Pernambuco .. " ...	10¼ 13	11½ 12¾	11 11¼	8½ 9	7½ 8½	7¾ 8	7¾ 8½	7 8½	8¼ 9¾	9¼ 11½	12¼ 14½	10¾ 12½
Egyptian ..... " ...	10¼ 12	9½ 11	7¼ 8¼	7 9	7 8¼	6¼ 8½	8 9½	7 8½	8 9½	12 12	15 16½	11¼ 14½
Surat. .... " ...	5¼ 7½	5½ 7	5 6	3⅞ 5½	3⅜ 5	3½ 5	4½ 5¾	3⅜ 5	4¼ 6	5½ 7¼	6¼ 8⅜	6⅛ 8
Bengal .... " ...	5½ 6¾	5½ 6¼	5 5½	4 5	3¼ 5	3½ 4½	4½ 5½	4 4⅝	4¾ 5½	5¼ 6½	7¼ 7¾	5½ 6½

1.—*Statement of the Extreme Prices in each Year, from* 1806 *to* 1835.

	1806. Good.	1807. Good	1808 Good	1809. Good	1810. Good.	1811 Good.	1812. Good.	1813 Good	1814 Good	1815. Good.	1816.		1817		1818.	
	d d	d. d	d. d.	d d.	d. d	d d	d d	d d	d. d	d d	d d	d d.	d d	d. d	d. d.	d. d.
Upland	15 21½	15¼ 19	15½ 36	14 24	14½ 22½	12¾ 16	13 23½	21 30	23 37	18 25½	15 a 1[illegible]	19½ a 21	16¼ a 20	19¾ a 23¼	16½ a 19½	20¼ a 22
New Orleans	17 24	18 21	17½ 37	17 36	16½ 23½	13¼ 17½	14 26	23 31	29 39	21 31	15 19½	20 24	18 20	23 25½	16½ 20½	21 25
Sea-island .	30 37	28 30	28 58	28 49	26 33	22 30	25 40	37 48	42 72	33 57	22 28½	26 39	22 30	25 36	25 36	33 54
Pernambuco	23¼ 29	24½ 26½	25 42	22½ 38	23 29	18 23½	19 27½	24 34	28¼ 41	25½ 37	23 24	29 40	22¼ 24	26¾ 27¾	22 23	26 27
Maranham..	21½ 26	22½ 24¼	22 38	19½ 36	20 27	14¼ 20¼	16 26	22 33	23¼ 39	26½ 33	22 22½	27¼ 28	22 23	25½ 26	20 20½	24¼ .
Surat	. 17	. .	14 25½	11 26	12½ 19	10½ 13	12 16	15½ 20	18 25	14½ 21	14 15	17 18½	14½ 17½	16 20	7 14	15¼ 20½
Demerara ..	22 26½	23 40	23 40	20 40	21½ 28	17 21½	17¾ 27½	24 33	27½ 39½	24 35	20 23½	26 29½	19 23½	23 26½	19 24	23 30

	1819.		1820.		1821.		1822.		1823.		1824		1825.		1826.	
	d d.	d d.	d d	d d	d. d.	d	d. d.	d. d	d. d	d d	d. d	d. d	d. d	d. d	d d	d d.
Upland	10 a 12½	17 a 19¾	8 a 11	12¼ a 13½	7¾ a 10	9¼ a 1[illegible]	5¼ a 8¼	7¼ a 11	6¼ a 8½	8½ a 10¾	7 a 8½	9 a 10	6 a 9½	16¾ a 19½	5¼ a 6¾	6 a 8¾
New Orleans	10½ 15½	16½ 21	8½ 14	12¾ 17	7½ 12½	9 14	6 10¼	8½ 12½	7 11	8½ 13	7½ 11	9 13	8 12	17½ 22	5½ 8	7 11½
Sea-island..	21 36	29 48	15 28	22 30	12½ 26	14 30	10 24	12½ 28	11¼ 22	13 24	11½ 22	15 27	15 27	33 42	10 20	17 30
Pernambuco	16 18	22½ 23½	11½ 13	17 18¼	11½ 12¼	13¼ 14¼	9½ 10¾	11½ 12½	10¼ 11½	13 14¼	10 11¾	11¾ 13	11¼ 12¼	22½ 23½	9½ 10¾	11 12
Maranham.	15 16	20¼ 21	11 11¼	16 16½	10¼ 11¼	12½ 13½	8¼ 9½	10¾ 11½	9¼ 10½	12½ 13½	9¼ 10¼	10¾ 11¾	1[illegible] 11¼	21½ 22½	8½ 9½	10 10¾
Egyptian ...	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	9¼ 11	11 12½	10¼ 12	21 24	6½ 8½	9½ 11
Surat	5¾ 10¼	8¼ 14½	6¾ 9½	7½ 12	6½ 8½	7 9¼	5½ 7½	6½ 8½	5¼ 7½	6½ 8½	5½ 7	5½ 8	5½ 7½	12 16	4½ 6	5½ 7
Demerara .	12¼ 18	19 24	11 14	14 19	9 13	11 14	7¾ 10½	9½ 13	8½ 11½	12 14	10 12	10 13	10 12½	19 24	7½ 10½	9½ 12¼

	1827		1828.		1829.		1830.		1831.		1832.		1833.		1834.		1835.	
	d. d.	d d.	d. d	d d	d. d	d d	d d	d d	d d	d d	d d.	d. d	d. d	d d	d. d	d d.	d d.	d d.
Upland.....	4⅞ a 6¾	6¼ a 7½	5 a 6⅜	6⅜ a 7⅜	4⅜ a 6⅛	5¼ a 7	5⅜ a 7	6½ a 7¼	4 a 6⅞	5¾ a 7½	5 a 7	6⅝ a 8	6½ a 7⅞	9¼ a 12½	7¼ a 8⅞	9¼ a 11	6⅞ 10¼	9⅝ 13¼
New Orleans	5½ 8¾	7 9½	5½ 8	6¼ 9	4½ 7½	6 9	5⅞ 8	6½ 9	5 7¼	6½ 8	5¼ 8	6½ 9	6½ 9	9⅝ 14	7¼ 10	9⅛ 12½	6¼ 12	9¼ 14½
Sea-island .	9¾ 18	11¼ 20	10 18	12½ 22	9 18	12 21	11½ 20	12 20	9½ 18	10½ 18	9½ 18	11 18	10¼ 18	14 22	13½ 20	18 26	7 30	10 33
Pernambuco	8 9	10 11	7½ 8½	8¼ 9¼	6⅞ 7¼	7½ 8½	7½ 8	8½ 9½	6¼ 8¼	7⅜ 8⅞	7¾ 8½	9¼ 10½	8½ 9[illegible]	12¼ 14¼	9⅝ 11	12¾ 14¼	10 13	16 18
Maranham..	7¼ 8	8¾ 9¾	7¼ 7¾	7⅞ 8½	5⅝ 6½	7¼ 7¾	6⅜ 7	7¼ 8½	6⅝ 7¾	7 7½	6 7⅞	8 9⅝	7⅜ 9¼	11½ 13⅜	8¼ 10¼	12 13¼	10 12	14 16¼
Egyptian ...	6¼ 8	7 8¼	6¼ 8½	7¼ 9	5¾ 7½	7 8½	6¼ 8¼	8¼ 10	7 8½	8 9½	7 9	8½ 9½	. .	. .	12 12¼	15½ 16½	10⅞ 13	20 21
Surat.......	3⅞ 5½	5 6½	3½ 5	3⅞ 5¼	2¾ 4½	3½ 5½	3 5½	4½ 6	3½ 4½	4½ 5¼	3½ 4¾	4⅜ 5¼	4¼ 6⅜	7 8¼	5 7¼	6¾ 8⅝	6 8	7 9
Demerara ..	6½ 9½	8 11	6¼ 9	6¼ 9½	5¼ 8	6¼ 9	5½ 8	7 10	6 9	6½ 10	6 9½	7 10	7½ 10½	10½ 13	8 11	11½ 15½	10 14	12 17

2.—*Statement of the Quotations of Cotton Wool in Liverpool, at the Close of each Week in the Year* 1835; *also of the Weekly Amount of Sales, and Proportion on Speculation.*

	JANUARY.				FEBRUARY				MARCH.			
	9th	16th	23d.	30th	6th	13th	20th.	27th	6th.	13th	20th.	27th
	d d.	*d d.*	*d d.*	*d d*	*d d*	*d d.*	*d. d.*	*d d.*	*d. d*	*d d.*	*d d.*	*d d*
Upland	8⅝a10¾	8½a10⅝	8½a10⅝	8½a10⅝	8¾a11	8⅝a11	8½a11¼	8¾a11¼	8¾a11¼	8¾a11¼	8⅞a11¾	9 a 11¾
New Orleans	8⅝ 12	8½ 12	8½ 12	8½ 12	8¾ 12½	8⅝ 12½	8½ 12½	8½ 12½	8¾ 12½	8¾ 12½	8⅞ 13	9 13
Sea-island	9 30	9 30	9 30	9 30	10 30	10 30	10 30	10 30	10 30	10 30	10 30	10 30
Pernambuco ...	12½ 14	12½ 14	12½ 14	12½ 14	12¾ 14	13 14	13½ 14½	13½ 14½	13½ 14½	13½ 14½	13½ 14½	13¼ 15
Maranham	11¾ 13	11½ 13	11½ 13	11½ 13	11¾ 13½	12 14	12 14½	12 14¼	12 14½	12 14½	12 14½	12 14¾
Egyptian	16 17½	15 17½	15 17½	15½ 17½	16½ 18	16½ 18	16 18	16 18	16 18	16 18	16 18	16 18
Surat	6½ 8	6½ 8	6½ 8	6½ 8	6⅝ 8	6⅝ 8	6⅝ 8¼	6⅝ 8¼	6⅝ 8¼	6⅝ 8¼	6⅝ 8¼	6¾ 8⅝
Demerara	11 15	11 15	11 15	11 15	12 16½	12 16½	12 16½	12 16½	12 16½	12 16½	12 16½	12 16½
Amount of Sales ..	16760	13625	18628	27730	138[illegible]6	16080	2[illegible]230	15500	16470	23170	29450	35290
Proportion on Spec	1500	1500	1500	1000	8500	1100	2500	1100	2500	2820	5[illegible]50	10700

	APRIL				MAY.					JUNE			
	3d	10th	17th	24th.	1st.	8th	15th	22d.	29th.	5th	12th.	19th	26th
	d. d	*d d*	*d d*	*d d*	*d d*	*d d*	*d d*	*d d*	*d d*	*d d*	*d d*	*d d.*	*d d*
Upland	9 a 11½	9½a11½	9½a12	9¾a12½	9¾a12½	9½a12½	9½a13	9½a13	9½a13¼	9⅝a13¼	9⅝a13¼	9⅝a13¼	9⅝a13¼
New Orleans.....	9 13	9¼ 14	9½ 14½	9½ 14½	9¼ 14½	9½ 14½	9¼ 14½	9¼ 14½	9½ 14½	9⅝ 14½	9⅝ 14½	9⅝ 14½	9⅝ 14½
Sea-island ...	10 30	10 30	10 30	10 3[illegible]	10 30	10 30	10 32	10 33	10 33	10 33	10 33	10 33	10 33
Pernambuco....	13¾ 15	13¼ 15	14 15½	14½ 16	14½ 16	15 17¼	15½ 17½	16 18	16 18	15¾ 17¾	15½ 17½	15½ 17½	15½ 17½
Maranham . ..	12 14¼	12 14⅝	13 14⅞	13½ 15½	14½ 15½	14 16	14 16	14 16[illegible]	14 16½	14 16½	13½ 16	13½ 1[illegible]	13½ 16
Egyptian	16 18	16 18	none	19 20½	19 21	19 21	20 21	20 21	20 21	19½ 21	19½ 21	19 21	19 21
Surat	6⅝ 8⅝	6⅝ 8⅝	7¼ 8¾	7 8¼	7 8¼	7 9	7 9	7 9	7 9	7 9	7 9	7 8¾	7 8¾
Demerara.......	12 16½	12 16½	12 17	12 17	12 17	12 17	12 17	12 17	12 17	12 17	12 17	12 17	12 17
Amount of Sales ..	12477	26180	35160	23570	16080	31[illegible]50	20010	23910	12738	12330	9950	16040	18237
Proportion on Spec.	1150	7800	12350	11000	2500	9200	3000	3[illegible]00	1750	2200	1500	1500	1500

Statement, &c.—continued.

	JULY.					AUGUST				SEPTEMBER.			
	3d	10th	20th	24th	31st	7th	14th	21st.	28th.	4th.	11th	18th.	25th.
	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.
Upland	9¾a13	9¾a13	9¾a13	9½a13	9½a13	9½a13	9½a13	9¼a12½	8½a12½	8⅝a12½	8⅜a12½	8¼a12½	8 a12½
New Orleans ..	9¾ 14½	9¾ 14½	9¾ 14½	9½ 14½	9¼ 14½	9½ 14½	9½ 14½	9¼ 14½	8½ 14½	8⅜ 14½	8 14	8 14	7¾ 14
Sea-island	10 33	10 33	10 33	10 33	10 33	10 33	10 33	10 33	10 33	10 33	10 33	10 33	9 33
Pernambuco	14¼ 16½	14¼ 16	14 16	13¾ 15½	13½ 15½	14 16	13¾ 16	13½ 16	13½ 15½	13 15½	13 14½	12¾ 15	12½ 15
Maranham	13½ 16	13¼ 15¼	13¼ 15½	13¼ 15	13 15	13 15	13 15	13 15	13 14¾	12¾ 14¾	12½ 14½	12½ 14½	11⅝ 14
Egyptian	17½ 19	17½ 19	[illegible] 19	16 18	16 17½	16½ 17½	16½ 17½	16½ 17½	16 17½	15 17½	15 17½	15 17	15 17
Surat	7 8½	7 8¼	7 8	7 8½	7 8½	7 8½	6¾ 8½	6¾ 8½	6¾ 8½	6¾ 8½	6¾ 8⅜	6½ 8¼	6½ 8¼
Demerara	11½ 16	11½ 16	11½ 16	11½ 16	11½ 16	11½ 16	11½ 16	11½ 16	11 16	11 16	10½ 15½	10½ 15½	10½ 15½
Amount of Sales ..	13101	11520	16170	11909	10859	24370	16[illegible]90	7210	9770	18996	11520	12336	19640
Proportion on Spec	500	550	450	200	500	4000	750	..	1000	1500	200	500	1500

	OCTOBER.					NOVEMBER				DECEMBER.				
	2d	9th.	16th	23d	30th	6th	13th.	20th	27th.	4th.	11th	19th	24th.	31st
	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.	d. d.
Upland.	7 a12	7¼a12	7½a12	7¼a11½	7¼a11½	7¼a11¼	7¼a11¼	7¼a11¼	7¼a11½	6⅞a10¾	6⅞a10½	6⅞a10½	6⅞a10½	7 a10½
New Orleans.....	7½ 14	7½ 13½	7¼ 13½	7¼ 13½	7 13	7 13	7¼ 13½	7¼ 13½	7½ 13½	6¼ 13½	6¼ 13	6¾ 12	6⅞ 12	6⅞ 12
Sea-island	9 33	9 32	9 32	9 32	9 32	7 30	7 30	7 30	7 30	7 30	7 30	7 30	7 30	7 30
Pernambuco	11¾ 14½	11½ 14¼	11½ 14¼	11½ 14	11¼ 14	10¼ 13½	10¼ 13½	10¼ 13½	10¼ 13½	10½ 13½	10½ 13½	10 13	10 13	10 13
Maranham.... .	11¼ 13½	11¼ 13¼	11 13	10¾ 13	10¼ 13	10¼ 13	10 13	10 13	10 12½	10 12½	10 12½	10 12½	10 12	10 13
Egyptian	14 16½	14 16	13 15½	12½ 14½	12 14½	11 15	11¼ 15	11¼ 15	11½ 14½	11¼ 14	10⅞ 13	10⅞ 13	10⅞ 14	11¼ 14
Surat	6¼ 8½	6¼ 8½	6¼ 8¼	6 8½	6½ 8¼	6¼ 8⅜	6⅛ 8⅜	6⅛ 8⅜	6⅛ 8	6⅛ 8	6 8	6 8	6 8	6 8
Demerara........	10 15	10 15	10 14½	10 14	10 14	10 14	10 14	10 14	10 14	10 14	10 14	10 14	10 14	10 14
Amount of Sales ..	16800	22885	26088	19370	16050	27260	24260	25400	10430	17070	22467	21220	24040	28061
Proportion on Spec.	..	2500	6600	700	1000	4600	4100	1550	500	2100	1250	800	3500	5600

3.—*Import of Cotton Wool into Great Britain, in the Year* 1835.

	LIVERPOOL. Jan.	Feb	Mar	April.	May	June	July	Aug.	Sept	Oct.	Nov	Dec	Total in 1835.	Total in 1834.	LONDON. Total 1835	LONDON. Total 1834	GLASGOW. Total 1835.	GLASGOW. Total 1834	Total Import into Great Britain in 1835.	Total Import into Great Britain in 1834.
Growth of U.S. from New Orleans ...	34853	34222	17786	31681	34702	18277	16373	41038	11572	5433	1576	12002	250515	275718						
Growth of Savannah.	17059	11700	14318	17390	15658	11374	13526	7763	3029	.	1000	5824	118641	123391						
„ Charleston.	645	12124	6729	8277	8875	11235	11910	3881	6045	1707	5956	19451	98653	108505	6230	5185	49949	55241	763193	733528
„ Other Ports	17344	20261	18202	23242	30913	20011	28878	26262	14120	13142	10752	6784	230211	165188						
Total American..	75713	78307	57035	80590	90148	60807	70787	78952	37764	20582	19281	37061	707020	673102	6230	5185	49949	55241	763199	733528
Brazil and Portugal..	16462	8350	7159	10921	9601	9524	13179	14640	11958	13207	11163	15336	142302	100451	1270	3195	.	.	143572	103646
Mediterranean......	459	733	.	2070	1748	741	2943	1198	10519	8485	4865	3525	37281	4235	1420	982	5020	60	43721	7277
East Indies.........	7094	3710	.	5244	4798	3234	885	4821	12278	2853	4853	13783	63556	47005	37816	29751	16593	12342	117965	89098
Demerara, West Indies, &c.........	2759	836	197	1249	748	1279	1307	4168	5707	1220	758	330	20558	14681	620	1279	1618	1525	22796	17485
Total packages ..	102487	91936	65191	100074	107038	[illegible]	89001	103779	78226	46347	40928	70035	970717	841474	47356	40392	73180	69168	1091253	951034

Increase of Import in 1835 140219

4.—*Import of Cotton Wool into Liverpool, from the Year* 1791, *in Packages.*

In 1791..68,404	1796..63,526	1801..98,752	1806 .173,074	1811..174,132	1816 .276,715	1821..413,182	1826..489,204	1831..791,582
1792..72,364	1797 .58,258	1802..135,192	1807 196,467	1812. 171,551	1817 .214,181	1822..453,722	1827..756,296	1832..779,071
1793 .24,971	1798..66,134	1803..140,291	1808 . 66,215	1813..141,188	1818 .425,344	1823..578,303	1828..630,245	1833 .840,953
1794..38,022	1799. 89,784	1804. 153,126	1809..267,983	1814 .182,626	1819. 365,365	1824. 447,083	1829. 640,998	1834 .841 474
1795..54,841	1800..92,580	1805..177,508	1810 .320,594	1815..270,635	1820. 458,736	1825..706,316	1830..793,605	1835..970,717

5.—*An Account of the Quantity of Pounds net (in millions and tenths) of Cotton Wool imported into Great Britain from the Year* 1801, *and at different Intervals prior to that Time.*

1701 a 1705 av. of 5 yrs 1·2	1786 a 1790 av. of 5 yrs 25·4		1805.. 59·7	1810. 136·5	1815.. 99·3	1820..143·9	1825..222·4	1830..261·2
1716 1720 ,, 2·2	1791 1795 ,, 26·7		1806.. 58·2	1811.. 91·6	1816.. 93·9	1821. 129·	1826..171·5	1831..280·5
1771 1775 ,, 4·8	1796 1800 ,, 27·3		1807.. 74·9	1812.. 63·	1817..124·9	1822..142·2	1827 .271·1	1832..287·8
1776 1780 ,, 6·7	1801 . 56·	1803.. 53·8	1808 43·6	1813.. 51·	1818..177·3	1823 .188·1	1828..219·8	1833..304·2
1781 1785 ,, 10·9	1802.. 60·3	1804.. 61·9	1809.. 92·8	1814.. 60·1	1819..149·7	1824..143·7	1829 .221·8	1834..320·6
								1835..361·7

6.—*Import into Great Britain from the Year* 1806, *distinguishing the Growth.*

	1806	1807.	1808	1809.	1810.	1811.	1812.	1813.	1814.	1815.	1816.	1817.	1818.	1819.	1820.
American...	124,939	171,267	37,672	160,180	246,759	128,192	95,331	37,720	48,853	203,051	166,077	199,669	207,580	205,161	302,395
Brazil ..	51,034	18,981	50,442	140,927	142,846	118,514	98,704	137,168	150,930	91,055	123,450	114,518	162,499	125,415	180,086
East India ..	7,787	11,409	12,512	35,764	79,382	14,646	2,607	1,429	13,048	22,357	30,670	120,202	247,659	184,259	57,923
Other sorts..	77,978	81,016	67,512	103,511	92,186	64,879	64,563	73,219	74,800	52,840	49,235	44,872	50,991	31,300	31,247
Packages ..	261,738	282,667	168,138	440,382	561,173	326,231	261,205	249,536	287,631	369,303	369,432	479,261	668,729	546,135	571,651

	1821.	1822.	1823.	1824.	1925.	1826.	1827.	1828.	1829.	1930.	1831.	1832.	1833.	1834.	1835.
American...	300,070	329,906	452,538	282,371	423,446	395,852	646,776	444,390	463,07[illegible]	618,527	608,887	628,766	654,786	733,528	763,199
Brazil	—	143,505	144,611	143,310	193,942	55,590	120,111	167,362	159,536	191,468	168,288	114,585	163,193	103,[illegible]	143,572
Egyptian ..	121,085	—	5,623	38,022	111,023	47,621	22,450	32,889	24,739	14,752	38,124	41,183	3,893	7,[illegible]	43,721
East India	30,095	19,263	38,343	50,852	60,481	64,609	73,738	84,855	80,489	35,019	76,764	109,298	94,698	89,098	117,965
W. India, &c.	40,428	40,770	27,632	25,557	31,988	18,188	30,988	20,036	18,867	11,721	11,304	8,490	13,646	17,485	22,796
Packages ..	491,678	533,444	668,797	540,09[illegible]	820,883	581,950	894,063	749,552	746,707	871,487	903,367	902,322	930,216	951,034	1,091,253

7.—*Comparisons of the Stocks at the Close of the Years* 1834 *and* 1835.

	Liverpool.		London.		Glasgow.		Total in Ports		Dealers and Spinners.		Total unconsumed.	
	1835	1834.	1835.	1834.	1835.	1834.	1835.	1834.	1835.	1834.	1835.	1834.
Upland	37,890	46 970			7,420	6,053						
Orleans	17,160	35,460			3,306	4,581						
Alabama	37,990	22,8-0	1,390	630			109,300	118,000	35,000	41,500	144,300	159,500
Sea island . . .	1,800	290			243	106						
Stained ditto . . .	1,500	340			564	163						
Pernambuco . .	10,070	3,470			80	388						
Maranham . .	10,160	3,110	590	1,369	201	292	33,800	11,800	8,000	10,000	41,800	21,800
Bahia	12,640	3,010										
Other Brazils . .	160	130			..	..						
Egyptian	18,280	1,120	180	76	1,945	..	20,500	1,700	1,500	500	22,000	2,200
Smyrna . . .	80	160	..	280		..						
Surat and Madras .	27,310	23,460	18,650	20,824	6,391	1,518						
Bengal, &c.	4,940	50	3,230	2,938	..	..	60,500	48,800	4,000	6,000	64,500	51,800
Bourbon	..	.	..	..	..	..						
Dem., Surinam, &c. .	230	240	460	123	570	171	5,900	5,300	1,500	2,000	7,400	7,300
West India, &c. . .	4,530	4,620			123	181						
Total . . .	184,700	145,310	24,470	26,300	20,843	13,953	230,000	185,600	50,000	60,000	280,000	245,600

Total unconsumed, 1st January, 1835, 82,320,000lbs. weight, average about 335lbs. per bag.
Ditto ditto, 1st January, 1836, 89,633,000lbs. weight, average about 320lbs. per bag.

8.—*General Statement of the Import, Export, and Consumption of Great Britain, in the Year* 1835.

(EXTRACTED FROM TABLES 3, 7, 10, 11.)

Stock in the Ports, 1st Jan., 1835 . . .		185,600
Ditto in Dealers' and Spinners' hands:		
England . . .	52,000	
Scotland . . .	8,000	
		60,000
Import in 1835		1,091,300
		1,336,900

Export to the Continent and Ireland:		
American	46,700	
Brazil and West India . .	2,800	
East India	52,600	
Egyptian	700	
		102,800
Taken for Consumption of England and Scotland from the Ports . .	944,100	
Decrease of Stock in hands of Dealers and Spinners	10,000	
Consumed in England, 861,500, or 16,567 bags per week; in Scotland, 92,600, or 1,781 bags per week .		954,100
Remaining on hand in the Ports, 1st January, 1836.		230,000
In Dealers' and Spinners' hands:		
England . . .	45,000	
Scotland . . .	5,000	
		50,000
		1,336,900

9.—*Summary Statement of the Consumption, Export, Import, &c., of Great Britain, for the last 20 Years.*

	1816	1817.	1818.	1819.	1820.	1821.	1822.	1823.	1824.	1825.
Average Weekly Consumption—Upland....	..	.	2,179	2,380	2,918	3,292	3,839	3,890	4,212	3,713
Orleans and Alabama	999	669	875	1,244	1,192	1,389	1,552	2,169	2,298	2,442
Sea-island	..	. ..	289	329	409	604	652	629	754	360
Total American	4,035	3,509	3,343	3,993	4,519	5,285	6,043	6,088	7,264	6,515
Brazil	1,589	2,075	2,459	2,456	2,408	2,503	2,646	2,577	2,890	2,502
Egyptian, &c.	..	..	..	..	..	..	..	..	362	891
East India	207	1,192	1,581	1,190	1,518	1,019	953	852	644	1,096
Demerara, West India, &c...	656	1,050	746	713	534	785	835	654	473	527
Total	6,488	7,826	8,129	8,352	8,979	9,598	10,477	10,771	11,633	11,531
Consumption of England.....	5,744	6 911	7,227	7,387	8,035	8,573	9,411	9,686	10,581	10,435
Consumption of Scotland..........	744	915	902	965	944	1,025	1,066	1,085	1,052	1,096
Taken for Consumption from Liverpool	5,514	5,914	6,609	7 064	7,987	7,855	8,789	8,900	10,917	9,313
Sold to Speculators in Liverpool...	28,700	33,700	26,600	46,800	36,000	32,000	23,000	160,000	81,000	458,000
Export	29,300	26,700	55,500	66,800	28,400	52,600	59,300	35,400	53,600	72,800
Consumption	337,400	407,000	422,700	434,300	466,900	499,100	544,800	560,100	604,900	599,600
Average Weight of Packages consumed ..	263	263	260	252	258	258	267	275	273	278
Weekly Consumption in Pkgs. av. 333lbs..	5,122	6,181	6,346	6,323	6,945	7,451	8,402	8,900	9,537	9,634
Average Weight of Import.	256	266	263	264	249	262	267	281	266	270
Lbs weight imported, in Millions and Tenths	93·9	124 9	177·3	140 7	143 9	129 0	142·2	182 1	143 7	222 4
consumed ditto ..	88 7	107	109 9	109·5	120·3	129·0	145 5	154 1	165 2	166·8
in Ports, 31st Dec ditto. ...	19·2	28·9	78·2	99 5	110·5	101·7	79·4	109 6	64 0	107·0
in Great Britain, ditto, ditto .	..	.	93·3	111·8	127·0	113·9	93·7	117·3	80·3	115·5
Packages in ditto, ditto	115,800	161,300	351,800	396,800	473,100	413,100	342,500	415,900	297,400	445,900
Increase } of ditto, in ditto, compared { .	..	45,500	190,500	45,000	76,300	..	..	73,300	..	148,500
Decrease } with the preceding year } . ..	..	..	..	..	..	60,000	70,000	..	118,400	..
Packages in Great Britain, 31st Dec, equal to week's consumption at the then average rate — American	8	11	19	13	24	23	20	32	13	23
Brazil	27	24	29	18	37	28	27	30	22	45
Egyptian	..	..	..	..	..	..	.	..	60	96
East India .. .	10	52	121	241	169	197	142	131	167	77
West India . ..	26	10	31	23	36	22	16	15	20	24
Ditto of all kinds	18	21	43	47	53	43	33	30	26	38
Lbs wt of Yarn exported, in Mills & Tenths	..	..	16 1	16·7	23·9	23 2	28·0	27·4	33.6	32·6
Average Quotation of Uplands in Liverpool.	18¼d	20½d	20d	13½d	11½d	9½d	8¼d	8¼d	8½d	11⅝d
Pernams ditto . ..	26d	25d	25d	18½d	15½d	12⅝d	11⅓d	12d	11⅝d	15⅛d
Surats ditto	15⅜d	17d	15¼d	9⅜d	8½	7⅞d	6⅞d	6¾d	6⅜d	8⅞d

Summary Statement, &c.—continued.

	1826.	1827.	1828.	1829.	1830.	1831.	1832.	1833.	1834.	1835.
Average Weekly Consumption—Upland ...	3,783	4,241	4,990	5,304	5,452	5,241	6,219	5,421	5,742	5,896
Orleans and Alabama	2,713	3,940	4,210	3,788	4,756	5,800	5,321	6,442	7,352	7,823
Sea-island	369	673	635	539	460	517	519	665	498	354
Total American	6,865	8,854	9,835	9,631	10,668	11,558	12,059	12,528	13,592	14,073
Brazil.	1,188	1,815	2,456	3,094	3,602	3,294	2,843	2,683	2,665	2,339
Egyptian, &c..............	975	1,142	671	485	508	619	881	279	131	446
East India	489	664	738	658	940	765	1,161	1,210	1,033	1,069
Demerara, West India, &c...	308	502	380	463	284	260	196	223	246	421
Total.............	9,825	12,977	14,080	14,331	16,002	16,496	17,140	16,928	17,667	18,348
Consumption of England	8,792	11,677	12,655	12,729	14,392	14,881	15,427	15,248	15,831	16,567
Consumption of Scotland.	1,033	1,300	1,425	1 602	1,610	1,615	1,713	1,675	1,836	1,781
Taken for Consumption from Liverpool....	10,180	12,164	12,714	13,089	14,127	15,316	14,906	15,710	15,848	16,806
Sold to Speculators in Liverpool..........	71,000	67,000	96,000	41,500	65,000	35,500	90,600	268,000	222,300	145,100
Export...	25,000	69,100	63,700	118,100	33,400	74,600	67,100	67,800	86,800	102,800
Consumption	51[illegible],900	674,800	732,200	745,200	832,100	857,800	891,300	880,000	918,700	954,100
Average Weight of Packages consumed	294	297	297	294	298	306	311	326	330	333
Weekly Consumption in Pkgs. av. 333 lbs. .	8,675	11,391	12,581	12,655	14,320	15,157	16,007	16,567	17,508	18,348
Average Weight of Import	295	303	293	297	300	310	319	327	337	331
Lbs. weight imported, in Millions and Tenths	171·5	271·1	219 8	221·8	261·2	280·5	287·8	304·2	320·6	361·7
consumed ditto	150·2	197 2	217·9	219·2	247·6	262.7	276·9	287·	303·4	318·1
in Ports, 31st Dec. ditto	89 0	129·2	112·7	80 8	91 4	81·3	76·5	66.9	63·2	73 3
in Great Britain, ditto, ditto.....	110·9	164 8	147 0	115·5	118·8	114·4	103 7	94·4	82 3	89·6
Packages ditto ditto	422,000	572,000	525,900	409,300	415,300	386,300	330,200	300,100	245,600	280,000
Increase of ditto, in ditto, compared	..	150,200	..	..	6,000	..	..	..	..	34,400
Decrease with the preceding year	[illegible],900	..	46.300	116,600	..	29,000	56,100	30,100	54,500	..
Packages in Great Britain, 31st Dec. equal to week's consumption at the then average rate — American..........	24	38	25	19	22	19	17	14	12	10
Brazil	69	53	53	35	29	26	17	24	8	18
Egyptian	84	39	64	60	31	33	16	8	17	49
East India.........	169	120	120	115	47	61	51	46	53	60
West India.........	42	35	44	25	29	24	20	17	30	18
Ditto of all kinds	43	44	37	29	26	23	19	18	14	15
Lbs. wt. of Yarn exported, in Mills. & Tenths	42·2	44 9	50·5	57·3	62 7	58·8	71·7	67·8	78·7	..
Average Quotation of Uplands in Liverpool.	6¼d	6½d	6⅜d	5¼d	6⅜d	6d	6⅝d	8¼d	8⅝d	10¼d
Pernams ditto ...	10½d	9⅜d	8⅜d	7¼d	8¼d	7¼d	9d	10⅜d	11⅞d	14⅛d
Surats ditto ...	5¼d	5⅛d	4⅜d	4d	5d	4⅝d	5d	6⅜d	6⅝d	7¼d

10.—LIVERPOOL.

Stock, 1st January, 1835		145,300
Import in 1835		970,000
Ditto from Gloucester		3,200
		1,118,500
Total quantity sold in 1835, as per weekly returns	1,036,200	
Deduct proportion sold to speculators for re-sale	145,100	
	891,100	
Forwarded to Country Importers, and Dealers importing coastwise, &c.	43,400	934,500
Stock remaining 1st Jan. 1836		184,000
Taken for Consumption and Export in 1835 . .	934,500, or 17,971 per wk.	
(In 1834, 882,000, or 16,961 bags per wk.)		
Deduct Export to Continent 51,900	60,600	
Ditto, Ireland . . 8,700		
Taken for Consumption . .	873,900, or 16,806 per wk.	
Ditto, Glasgow Market . .	25,800	
Do. for Consump. in England,	848,100, or 16,309 per wk.	
In 1834 . .	789,000, or 15,173	

11.—LONDON.

Stock, 1st January, 1835		26,300
Import in 1835		47,400
		73,700
Stock, 1st January, 1836	24,500	
Exported to the Continent . . .	40,600	67,300
Ditto Glasgow . . .	2,200	
Taken for Consumption in England . . .		6,400

or 123 bags per week.
(In 1834, 9,200, or 177 bags per week.)

12.—GLASGOW.

Stock, 1st January, 1835		14,000
Import in 1835		73,200
Ditto from London		2,200
Ditto from Liverpool		25,800
		115,200
Stock, 1st January, 1836 . . .	20,800	
Export to Liverpool	3,200	25,600
Ditto Ireland	1,600	
Taken for Consumption in Scotland . . .		89,600

or 1,723 bags per week.
(In 1834, 95,000, or 1,836 bags per week.)

13—*Growth of America.*

Crop of	bags.	Crop of	bags.
1820–1	430,000	1828–9	870,415
1821–2	455,000	1829–30	976,845
1822–3	495,000	1830–1	1,038,847
1823–4	560,000	1831–2	987,477
1824–5	569,259	1832–3	1,070,438
1825–6	720,027	1833–4	1,205,3[illegible]
1826–7	957,281	1834–5	1,254,328
1827–8	720,593		

(In 1785, the Import into Liverpool from America was only 5 bags; in 1786, 6 bags, in 1787, 108 bags.)

Remarks.

The Tables of *Import* into the kingdom, compared with the preceding year, show an increase of 29,671 American, 39,926 Brazil, 36,444 Egyptian, &c., 28,867 East India, and 5,311 West India,—total, 140,219 bags.

The average weekly *consumption* of Great Britain we estimate at 18,348 bags, consisting of 5,896 Upland, 7,823 Orleans and Alabama, 354 Sea-island, total 14,073 American, 2,339 Brazil, 446 Egyptian, &c., 1,069 East India, and 421 West India, &c., being an increase upon the consumption of last year of 781 bags per week; but in packages of the average weight of the consumption of that year 870 bags per week, or for the whole year an increase of 14½ millions of lbs. weight.

The average weekly quantity taken by the *trade* from the *ports* is 5,781 Upland, 7,823 Orleans and Alabama, 344 Sea-islands,—total 13,948 American, 2,300 Brazil, 465 Egyptian, &c., 1,031 East India, and 411 West India, &c.,—total 18,155 bags.

The average *weight* of the import we calculate at 321 lbs. per bag for Upland, 402 Orleans and Alabama, 322 Sea-island, [illegible] Brazil, 218 Egyptian, &c., 360 East India, and 230 West India, &c., making the total import in lbs. weight 361,685,000, being an increase upon last year of 41,105,000 lbs.

We commenced the present year with the price of fair Uplands at 9½*d*. Under the influence of a good trade, and with the most confident statements of its continuation daily repeated by those most interested therein, our market gradually rose in price until June, when fair Uplands readily commanded 11*d*.

Here the market rested for some time.

During the first quarter of the year long-stapled cotton of all de-

scriptions became very low in stock; so much so, that, at about the beginning of May, some fear of an absolute scarcity was gravely spoken of. The consequence was comparatively high prices, (Pernams were then quoted at 16*d.* to 18*d.*, and Maranhams 14*d.* to 16½*d.*,) and that again naturally tended to throw them out of consumption, by diverting the demand in a still greater degree upon the better qualities of Mobiles and Orleans, as substitutes.

At these raised prices the market continued for about three months, consumers abstaining from buying to the utmost of their power, and the importers and holders daily hoping for a renewal of the demand. In the mean time orders were sent abroad under the promise of high prices, and our market soon became heavily stocked with high-charged cotton, leaving an immense loss on all imports, whether from the United States, Brazil, India, or Egypt.

The market, however, sustained itself pretty firmly until the close of August, when the accumulated weight gradually broke down prices, until they finally settled at the present rates, being ⅜*d.* lower for fair Uplands than at the close of last year, and 1¼*d.* for inferior. The good quality of the new crop is at about the same rate—rather lower.

It may be noticed that the state of the market before adverted to, with regard to long-stapled cotton, brought about its own remedy,—reduced consumption, and increased import, until Brazils, Egyptians, &c., have settled at comparatively very moderate rates.

We have thus endeavoured briefly to sketch the changes in the market of this great staple, referring with much satisfaction to the subjoined tables for a proof of the continued progress and steady increase of the manufacture of this article.

We made a short remark on this subject in our printed circular of 24th July, stating the probable increased consumption at 1,000 bags per week. With every desire to estimate the increase at as low a rate as we can, conformably with the stocks, imports, &c., we now find we cannot state the increased consumption at less than 870 bags per week, of the average weight of last year.

With respect to the raw material, the great objects to be desired are, that the prices on the one hand should be sustained at such a rate as to continue an abundant supply, and, on the other, that they should not rise to such a pitch as to repress consumption.

Speculators have not taken any great interest in our market during this year.

George Holt & Co., *Brokers.*

Liverpool, 31st *December,* 1835.

BOOK III.

ORIGIN, PROGRESS, AND PRESENT STATE OF THE MANUFACTURE OF COTTON BY MECHANICAL POWER.

CHAPTER I.

Early History of the Factory System.

The general survey of the cotton manufacture portrayed in Book I. exhibits no systematic character, but betrays the tottering and wayward steps of infant industry. The labours of artisans were insulated or partial efforts prompted by immediate necessity, and liable at every instant to be arrested, or turned into a new direction by belligerent rulers, regardless of the wishes and interests of the community. But Providence, meanwhile, had been preparing a great revolution in the social frame, which has become mature only in these latter days; teaching mankind by a series of severe lessons, that poverty and wretchedness were the inevitable results of military pride and glory; and that national dignity and happiness were to be found only in the friendly concurrence of many different kingdoms towards the creation, interchange, and distribution of the various objects, material and intellectual, which conduce to the well-being of our race.

In reference to this devout consummation, the annals of humanity are divisible into four eras, each of them characterized by peculiar attributes. The *first* epoch was marked by the development of the beautiful in

form, sentiment, and expression. From the liberal encouragement given to men of genius in Greece, while Pericles administered the Athenian state, this brilliant period of history is deservedly designated by his name. Models of architecture, statuary, poetry, and popular eloquence of such perfection then appeared, as have never been rivalled since, and will probably remain inimitable studies to every coming age. The intolerance of party spirit in Greece, miscalled patriotism, while it bent the faculties of its citizens to their utmost strain, and drew forth those masterpieces of invention, encouraged at the same time. pride, envy, hatred, and licentiousness to a pitch incompatible with peace or stability, and ere long involved their country in a ruin which centuries have shown to be irretrievable.

There was in truth an efflorescence of glory upon the summits of society in Athens, while a canker worm was gnawing the roots. Idleness and insolence were the badges of its citizenship. Attica was peopled with 400,000 slaves, but recognised only 20,000 freemen entitled to bear arms. The slaves cultivated the land, exercised the mechanical arts, worked in the mines, dug in the quarries, and performed every kind of menial drudgery. Petty rival communities so constituted could neither accumulate capital, nor secure for a series of years, the means of independent livelihood. Their most considerable citizens were for the most part worse clothed, worse fed, and less comfortably lodged than the tradesmen of England at the present day.

The *second* great epoch of civilization commenced when the Roman arms, by framing the discordant nations round the Mediterranean shores into one

submissive empire, prepared a highway for the missionaries of Galilee to propagate with miraculous powers the philanthropic system of their divine Master, and to substitute for the reckless virtue deified by the Stoics the evangelical doctrine, that all must seek their own well-being by promoting the well-being of others, because mankind are one brotherhood of immortal spirits, precious in the sight of their heavenly Parent, and candidates of a common salvation. The perfect equality in social rights of men of every rank and of every nation was now publicly declared upon infallible authority; and though this principle has had to contend at every period, and in every state, with the prerogatives of pride and the follies of prejudice under a thousand different forms, yet ever since its evangelic promulgation, it has been steadily gaining ground, and widening its benign influence throughout the world. In the course of a few generations it destroyed the distinction between the master and the slave, which had disfigured every ancient commonwealth, and thereby proved that productive industry was the duty of all men without exception.

The leading features of the *third* epoch are the wide diffusion of knowledge among all classes of society, by the invention of the printing press, and the free intercourse of nations from the general use of the mariner's compass in navigation. The stores of learning, hitherto accessible to a favoured few, were now laid open to the many, rich as well as poor, with unsparing distribution. Distant communities, strangers to those petty jealousies which usually lead neighbouring people to hate and harass each other, were brought into friendly relations by the directive polarity of the mystic needle.

The commodities of one country were prized in another in proportion to their rarity as well as usefulness; whence home manufactures and foreign traffic were mutually promoted. Now Venice, Genoa, Florence, and Pisa, emerging first from the miseries of Vandalism, became emporia of great wealth and consideration; by the accumulation of capitals unparalleled in ancient times, they could command the industry of remote nations, and the homage of absolute kings. From this period, commercial expeditions began to be fitted up at great expense for the most distant parts of the globe, and their profitable returns were waited for with confidence from one season to another.

The influence of freedom in favouring the development of productive industry was likewise wonderfully exemplified in the rapid aggrandisement of Lubeck and the other towns of the Hanseatic League, at a period when the great monarchies of Europe, patrons of the restrictive and monopolist system of trade, could not find funds to equip a small armament for a brief campaign, except by placing the crown jewels in pledge with money lenders.

The *fourth* era, or that of consummation, began when the operative classes, having become the disciples of science, and studious of the laws by which creative wisdom regulates the material system, resolved to enlist the latent powers of nature in their service. Many of these marvellous powers had been for years familiar to the philosophers of the school of Newton; but they were not diligently pondered by practical men for the purpose of applying them to the business of life till the middle of the last century. No experiment ever contributed so much to popularize natural

knowledge, or ever shed so bright a halo round its author's head, as that of the electrical kite, when Benjamin Franklin, by no random hit, but in consequence of a most sagacious and elaborate train of researches, dared to interrogate the thunder-cloud as to its awe-inspiring essence, to draw down its terrific bolt in a stream of lambent fire, and to make it the subject of sportive shocks and illuminations. The oriental fabulists in their wildest luxuriance of fiction never matched the real exploit of the sage of Philadelphia —stealing lightning from the heavens, and imprisoning it—in a phial. As the feeblest flame may kindle the mightiest conflagration, so these few sparks of celestial fire were ordained to be the means of lighting up the hallowed flame of freedom in the most corrupt monarchy of Europe, and of inducing multitudes of votaries to do homage in the temple of science, who would otherwise have never entered her gates. The noble discovery of the identity of lightning and common electricity, surmised by many minds before, but first intrepidly proved by Franklin, gave him, when ambassador for his mother country, an influence in the despotic court of France most propitious to the establishment of the American Republic.

Franklin was not, however, the sole agent then employed by Providence to inspire the man of business with the love of philosophical research. He indeed led the van of the illustrious train who were devoting themselves with generous assiduity to explore the dark recesses of nature, in order to extort her secrets, to obtain the mastery of her powers, and to make them minister to the weakness and the wants of their fellow creatures.

Three individuals were then maturing in the city of Glasgow faculties destined not only to open up inexhaustible resources to their own country, but to add indefinitely to the wealth and comfort of the whole family of man. These were Joseph Black, James Watt, and Adam Smith. The first of these philosophers had, within a few years after Franklin's grand experiment, made his important discovery of the existence of a fixed air in marbles and other calcareous stones, which came forth in an elastic state when they were calcined into quicklime. This was one of the early blossoms of that pneumatic chemistry, which has yielded since so rich a harvest of truths in every district of the animal, vegetable, and mineral kingdoms. Continuing to pursue the links of that hidden chain which binds together the apparently incoherent events of the physical world, Black next proceeded to search out the laws of latent heat.

When we now look back into these inquiries, so simple in statement, so conclusive in proof, and so vast in consequence, we cannot help feeling astonished at the carelessness with which the congelation of water and the melting of ice, as well as the generation and condensation of steam, had been regarded by all preceding observers, whether learned or unlearned. It was reserved for the sagacious hand of Black to seize the mystic links of the phenomena, to place them for ever within the reach of man, and to enable him to dispose of them at pleasure, in modifying matter for the uses of art, or in exploring still further her multiform transmutations. His first achievement was to make us familiar with one invisible spirit—a specific kind of aerial substance: his second was to disclose the constitu-

tion of aerial being in general, and its relations with the solid and liquid forms of existence.

James Watt had a kindred mind, and was pursuing independently a kindred train of research on the mysterious powers of heat, though with less general, or rather with more directly practical, views. He had turned his attention minutely to the steam engine, which for nearly sixty years before his time had essentially remained the same rude and unwieldy prodigy which Newcomen had conjured up, though it had been often modified in outward appearance. Towards the general enlargement of his mind, Watt had undoubtedly derived profit from the public lectures of Black, which he occasionally attended, though he was by no means a regular student; but he was not indebted to the professor of chemistry for his ideas on the latent heat of steam, as has been sometimes said. This statement I make on the authority of a conversation I had with Mr. Watt himself, a few years before his death. Benjamin Franklin made use of a phial to receive the fire of lightning, and to verify its analogies with the common electricity of the charged Leyden jar. James Watt also made use of a phial to demonstrate both the latent heat and the expansible tension of the vapour of water.* If we call to mind the sorry plight in which this great mechanician found the steam-engine, and the condition to which in a few years he brought it, both as to principle and execution, ready to drain the deepest mine, to animate the greatest factory, to fly along the railway, or to march with giant strides over the crested billows, we must regard

* Communicated to me in the conversation alluded to above.

the author of this application of science as no secondary star in the constellation then ascendant.

In reviewing the golden dawn of modern civilization, we must not however fail to mention with due reverence the name of Adam Smith, that master-spirit who first expounded with systematic perspicuity the science of social comfort,—the art of turning the industry of nations to the best account, or, in other words, the principles of the production, the distribution, and the consumption of wealth.

To the same brightening era the mode of finding the longitude of a ship at sea may be justly referred. The mariner's compass, which on its first introduction was hailed by the navigator as an unerring guide in the trackless deep, had, in the course of the distant voyages to which it led, betrayed many strange aberrations. "True as the needle to the pole" still continues with the multitude a favourite illustration of constancy, though the needle has been proved by old experience to be as fickle and faithless in its attachment to that point in the heavens as the living objects it has been compared to are to theirs. Upon a few favoured spots indeed of the terraqueous surface the needle does traverse due north and south, but everywhere else it deviates from that direction by angular quantities which differ not only in different parts, but in the same part in different years.

Science had not been an inattentive spectator of the embarrassments caused to the navigator by these variations of the compass. Astronomy had long ago taught him to determine the latitude of the ship, or its distance counted in a line due north or south from the equator, whereby he could deduce from time to time

the declination of his needle; but she reserved her chief gift to crown the period under review.

The great problem of the longitude was now practically solved, first by means of chronometric mechanism, and afterwards by lunar observation. Each method has been eventually brought to a pitch of perfection highly honourable to our age and nation, and both together give a security and promptitude to naval enterprise, which even the confident spirit of Columbus would have deemed unattainable.

The same age in which the union of science and art was thus happily consummated fortunately found society, in Great Britain at least, prepared, by the accumulation of capitals during a long period of peace and security, to cherish their prolific offspring, and to rear them up to a productive maturity.

I shall now draw the attention of my readers to a few events contemporary with the above, which mark the rising spirits of the time—the harbingers of the great factory system of Lancashire—the main subject of the present work.

In the year 1753 Parliament originated the British Museum by the purchase, 1st, of Sir Hans Sloane's cabinet of natural history, &c., for £20,000; 2dly, of the Cottonian library for £10,000; and, 3dly, of Montague house; for the reception of these and such other collections as might be added. The money required for these excellent purposes was raised, however, by the mean and immoral expedient of a lottery of £300,000 in one hundred thousand tickets of £3 each. £200,000 were given in prizes, and £100,000, after deducting the expenses of the lottery, were reserved for the Museum. Such was the beginning

of the only scientific establishment erected by the government of Great Britain. Fortunately the better spirit which animates the Administration and Parliament of modern times, promises ere long to make the mean origin of the Museum be forgotten in the magnificence of its completion.

The British Linen Company, incorporated at Edinburgh by Act of Parliament in the year 1746, was greatly instrumental in the extension of that and the other manufactures of Scotland. They advanced ready money to diligent trades-people for their goods, and thus enabled them to carry on their useful toils. In the course of twenty years that manufacture increased from the annual value of £166,000 to £334,000, a prodigious amount of business for that poor country at that time.

The linen trade of Ireland assumed an equally flourishing state. At the accession of William III., Ireland did not export to the value of £6,000, whereas in 1741 it exported annually £600,000 worth of linen goods. "No women," says Sir William Temple, "are apter to spin linen thread well than the Irish, who, labouring little in any kind with their hands, have their fingers more supple and soft than other women of the poor condition among us." We shall find in this circumstance one of the causes of the development of the cotton trade of Lancashire. The flax machinery of Leeds has now nearly supplanted the apt spinsters of Ireland, but it has in return supplied them with abundance of good and cheap linen yarn to weave in their domestic looms. In 1759, Ireland exported £939,562 sterling worth of linen; and Scotland stamped to the value of £451,390.

The canal of the Duke of Bridgewater is a splendid achievement of this period. This nobleman had the honour of rendering inland navigation an object of universal interest, and of inducing capitalists to cultivate this ample field of private revenue and public improvement. The enterprise was eminently successful, the Duke having wisely entrusted its execution to a man of remarkable genius for canals, James Brindley. The scoffers of that time, who nick-named his lofty aqueduct over the Irwell, *a castle in the air*, had reason ere long to be ashamed of their narrow-minded sarcasms; for a boat passed along it, sailing over the river at an elevation of thirty-eight feet, in July, 1761. This is the most magnificent work of public utility ever executed by an individual, one which has proved an inestimable benefit to the industry of England, more especially to the counties of Lancashire and Cheshire, which it traverses. The cotton trade of England is under peculiar obligations to this truly patriotic capitalist. His liquid highway sends arched ramifications of considerable length even under the town of Manchester; from one of which coals are hoisted by a coal-gin, through a shaft, out of the boats below, into a large store-yard in the main street. At this place the successors of the Duke were by Act of Parliament bound to supply the inhabitants of Manchester with coals at only 4*d*. per cwt. of 140 lbs.; a circumstance which must have had an immense influence in expanding their industry during the last seventy-five years. The canal contains seventy miles of level, many extensive tunnels, several noble aqueducts, and cost little less than half a million of money. Thus Lancashire was providentially sup-

plied, at a most critical period, with a great arterial trunk and numerous branches, to supply its industry with vital warmth and circulation, as also to open up channels of commercial intercourse with the eastern and western seas.

The decriers of the Duke (for eminent virtue is sure to breed envy in sordid minds) had the folly to object to his scheme, that canal navigation would greatly diminish the numbers of the useful and noble breed of draught horses. What, however, has been the result? The breeding of tens of thousands more to meet the demand for them created by the vast improvements in the husbandry, manufactures, and commerce of the canal districts of Lancashire and Cheshire—not to mention the numbers employed in dragging the boats which soon after its completion began to cover its surface. It was also objected that inland navigation would lessen the coasting trade, injure this nursery of seamen, and thus impair the navy. How has experience put the croakers to scorn! In the year 1760, just before the Bridgewater canal was completed, the shipping cleared out of the English ports amounted to 471,241 tons. In 1790, when a great part of England was intersected by canals, after the example of the Bridgewater enterprise, the tonnage had become 1,379,329, being very nearly trebled. Canals are in fact a contrivance to enable one horse to transport as great a lot of merchandise as thirty could do on a good road, or fifty on an indifferent one. And how expensive are roads to maintain in comparison of canals! Brindley's thoughts were so engrossed with the value of canals, that he said the main use of rivers was to supply them with water. Mrs. Barbauld has alluded to this idea

in the following couplet of her beautiful poem on canal navigation:

> The ductile streams obey the guiding hand,
> And social plenty circles round the land.

The water-ways of England now radiate from six central points—Manchester, Liverpool, Birmingham, Hull, London, and Bristol, furnishing such easy commercial transport that each of these emporia of trade participates in the ingenuity and opulence, not only of the other five, but of all the interjacent counties. Their produce, however ponderous or unwieldy, is circulated through these numberless artificial channels with economy, security, and promptitude

The railways now constructing in so many directions throughout Great Britain, will form an invaluable complement to canal navigation, and render the whole island one compact and continuous mart of industry.

In 1762, Mr. Harrison received from the Board of Longitude a further sum of £1,500, and next year from Parliament £5,000, on condition that he should disclose the principle on which his time-keeper was constructed. The government promised to pay him the remainder of the great reward of £20,000 if on further trials in the course of four years his chronometer should still be found capable of ascertaining the longitude within the required limits of exactness. Never was national munificence more wisely bestowed, for it excited an ardour of improvement in mechanics, in practical astronomy, and in navigation which soon brought the solution of the grand problem of the longitude to a state of simplicity and precision greater than Newton

himself could have anticipated. Harrison received eventually the whole of the £20,000.

If we consider the contemporaneous dawn of chemical art then enlightened by scientific principles, we shall find here also a most auspicious omen of the new age f industry. In 1763, Josiah Wedgwood produced the first fine specimens of his pottery, a production destined very soon to give a fresh impulsion to the national resources, and add fresh laurels to the fame of England. Prior to his time, our stoneware manufacture had moved round in a vulgar routine, estranged alike from philosophy and the fine arts. Wedgwood first procured it this noble alliance, whereby he raised it in a few years to supreme estimation, not only among his countrymen, but among all people who could appreciate taste and excellence. In spite of the heavy duties imposed upon his goods by foreign governments jealous of our rivalry in trade, no less than five-sixths of the English pottery made with these improvements were exported. The distinguished French traveller and *savant* Faujas Saint-Fond, thus speaks of Wedgwood's manufacture. "Its excellent workmanship, its solidity, the advantage which it possesses of standing the action of fire, its fine hard glaze impenetrable by strong acids, the beauty, convenience, and variety of its forms, and its moderate price, have created a commerce so active and so universal that in travelling from Paris to Petersburgh, from Amsterdam to the furthest point of Sweden, and from Dunkirk to the southern extremity of France, one is served at every inn upon English stone-ware. The same fine article adorns the tables of Spain, Portugal, and Italy; it provides cargoes for ships in the East Indies, the West Indies, and America."

He properly ascribes that excellence and economy, which rendered these manufactured objects the desire of all civilized countries, to the chemical and classical genius of Wedgwood. What a contrast does the traveller from Dunkirk to Marseilles now find in the wretched quality of the stoneware placed before him at the inns, in consequence of the French government continuing to act upon the barbarian polity of Bonaparte, which renounces all the comforts derived to their people from commercial interchange with their neighbours, in order to discourage, and, as far as possible, to destroy, the productive industry of every non-tributary nation!

The relative influences of internal peace and internal war on the credit of nations, were strongly contrasted in the comparative soundness of the English capitalists, and unsoundness of the continental, at the termination of the seven years' contest of 1763; nor can there be a doubt, that our stability at this crisis proved most propitious to the rapid growth of the new modes of cotton spinning then coming into play. The failures which happened at this period in Holland, Hamburgh, and Berlin, spread dismay through every commercial town on the continent, and called forth most despondent letters on the subject from the bankers of Amsterdam to those of London. A noble opportunity now occurred to British merchants of manifesting the extent of their capitals, the solidity of their credit, and the generosity of their spirit. They remitted loans without security to their foreign correspondents, whose condition was deemed precarious by the rest of the commercial world, to a very great amount; and by this means happily allayed the panic which had begun to paralyze

many houses well known for integrity in their transactions. Vast remittances were made to the commercial cities where the deepest distress was found to prevail by many of the leading firms of London, and they were liberally seconded by the Bank of England discounting an immense number of bills of exchange. "If the resources of Britain," says Chalmers,* "arise chiefly from the labour of Britain, it may be easily shown, that there had never existed in this island so many industrious people as after the return of the peace in 1763."*

The institution of the Society, in the Adelphi, for the Encouragement of Arts and Manufactures, ought, perhaps, to have had an earlier notice in tracing out the foundations of the new system of automatic industry, but this patriotic body, though it was incorporated in 1754, in imitation of similar societies previously organized in Dublin and Edinburgh, exercised but a feeble influence upon public improvement till several years after its origin. In fact, such powerful pecuniary means were not placed at its disposal by the government, as were possessed respectively by the Irish and Scotch societies for promoting their great indigenous occupations of the linen trade and the fisheries.

We may also mention here a circumstance which operated very strongly to throw the balance of industry at this time in favour of Great Britain, against the rival pretensions of France. The French government, by reducing, in the year 1770, the interest on its national debt to one-half of the stipulated rate, and also by depriving the holders of its stock of the

* Chalmers's Estimate of the Commercial Power, &c., p. 136.

benefits of survivorship, brought great distress upon their whole country. This arbitrary act of public plunder not only ruined many thousands of private individuals, but gave such a vital blow to general credit, as to cause an immense number of bankruptcies, disorganizing trade and manufactures with wide-spread misery. One house at Marseilles became insolvent for 20,000,000 livres.*

Many causes concurred to prevent the formation in the several states of Germany of any great factory system. Under the influence of jealousies and enmities each of them imposed fiscal restrictions on the sale of his neighbours' goods in the interior, and also obstructed their transit in search of foreign markets. Mining was the only department of industry which was permitted to assume a manufacturing extent, because it supplied the governments with resources in the sale of metals to the circumjacent people for making implements of husbandry and of the arts; yet even *it* was embarrassed by frivolous regulations. Germany has besides had the misfortune for ages to be the battlefield on which the sovereigns of Europe chose to settle the quarrels of their animosity and ambition; and could not therefore present to capital the security and repose essential to the development of industrious combinations.

Great Britain, on the other hand, has enjoyed admirable opportunities for cultivating productive industry and traffic on the greatest scale; perfect security from external invasion and from internal misrule, during more than a century; free intercourse between its several provinces

* Macpherson, vol. iii. p. 497.

at home facilitated by fine roads and canals; and with its colonies abroad and other distant nations by myriads of merchants' ships sailing every sea under the protection of a triumphant navy. Thus the productions of every clime were abundantly supplied either to gratify taste and encourage consumption, or to furnish raw materials to the mechanical and chemical arts. Nor ought we to place in the back ground of the picture its inexhaustible mines of the useful metals, most advantageously worked by its fire instinct steam-engines, and cheaply smelted by its boundless stores of pit-coal. But, certainly, nothing has so directly contributed to the pre-eminence of Great Britain in manufactures as her race of laborious, skilful, and inventive artisans, cherished as they have been by the institutions of a free country, which opened to the possessors of talents and knowledge, in however humble a station, the amplest career of honour and fortune to stimulate effort and dignify success. The reformation of religion, in spreading knowledge through the middle and lower classes of society, has distinguished the Protestant population even in Catholic countries for their superior skill in the useful arts; a fact illustrated in a remarkable manner at the revocation of the edict of Nantes, when Protestantism, being banished from France, drew away manufactures in its train, and enriched all those neighbouring states which gave the conscientious exiles shelter and protection. The number of holidays in Catholic countries has always proved a great obstacle to factory labour, which more than any other form of industry cannot brook interruption or suspension without serious injury to the machines, and to the quality of the workmanship.

In many districts of England a most laudable zeal to encourage the arts prevailed at an early period of their growth. Thus the warden and fellows of Manchester College, in order to lead ingenious strangers to settle in their town, granted them, nearly two centuries ago, the benefit of their extensive woods to cut timber for constructing their looms, as well as for fuel, at the trifling annual charge of 4*d*. each. The pre-eminence of Lancashire in manufactures soon after Elizabeth's accession is well marked, by an Act of Parliament in the eighth year of her reign, for regulating the *aulneger*, or cloth-measurer, an officer originally created by Richard I. The aulneger is here empowered to appoint and have his lawful deputy within every of the several towns of Manchester, Rochdale, Blackburn, and Bury in the said county. How completely these marts of industry are the offspring of nature may be inferred from the cirumstance, that they continue to maintain at the present day nearly the scale of importance indicated by the above order of enumeration.

Whether the fustians mentioned by Guicciardini were a pure cotton fabric or a mixture of cotton with wool or linen is now very uncertain, but it was most probably an Italian or Spanish invention, introduced into Antwerp in the course of trade, and thence made known to the industrious weavers of Ghent, by whom it was extensively manufactured. From the Netherlands it was brought over into England by the religious refugees, who were mostly artisans; several of whom settled at Bolton and Manchester. This important branch of business cannot be traced farther back than the conclusion of the sixteenth century. There can be little doubt that the warp of fustians was

generally linen yarn; a circumstance accordant with the testimony of Roberts in his Treasure of Traffic, already referred to.

This compound manufacture continued to flourish in Bolton, Leigh, and other small towns in Lancashire; the fabrics being sold chiefly at Bolton in an unbleached state to the Manchester dealers, who got them finished before they sent them into the general market. Curious names, more or less characteristic of the aspect or texture of the stuffs, were given to them by the weavers; such as herring-bones, pillows for pockets, and outside wear, strong cotton ribs and barragon, broad-raced linen thicksets and tufts, with whitened diapers, dimities, and jeans. At an after period, another style of goods became popular under the more appropriate titles of cotton thicksets, goods figured in the loom or draw-boys, (named from the draw-boys by whose assistance they were woven,) cottons, velvets, quiltings, velveteens, strong or fancy cords, and counterpanes. This business derived its raw material chiefly from the Levant and from Ireland; the former supplying cotton and also some cotton yarn for wefts, the latter linen yarn for warps.

In the early part of the eighteenth century, Dr. Stukely describes the trade of Manchester as incredibly large, consisting greatly in fustians, girth-webs, tuckings, tapes, &c., which were dispersed all over the kingdom and to foreign parts.*

The imports of cotton wool from the end of the seventeenth century till the middle of the eighteenth seem, however, to have remained in a stationary con-

* Itinerarium Curiosum.

dition. In fact, the quantity was only 24,000 or 25,000 pounds less than 2,000,000 in each of the years 1697, 1701, and 1720. But in 1730 it had fallen down to little more than 1,500,000, and in 1740 it was only one million and two-thirds. In 1750 it rose to about 3,000,000, and in 1764 it amounted to nearly 4,000,000, betokening the auspicious noon-day of the cotton-trade of England. The importation of cotton wool was greatly kept in check by the large importation of East Indian cotton goods, which continued with fluctuations during the whole of the eighteenth century, with the exception of a short period towards its close, after the application of the machinery of Arkwright to spin warp, and that of Crompton to spin weft for muslin yarn in general.*

Since the average annual import of cotton wool was considerably under 2,000,000 pounds during the first half of that century, and since a good deal of it was spun into candlewicks, the spinning of cotton yarn would seem to have remained almost stationary during that long period, in consequence of the quantities of Indian yarn sold by the East India Company and of cottons introduced by contraband.

It is not, however, fair to place to the credit of cotton alone the main value of the fustians, and the other so called cotton-stuffs then manufactured in Lancashire, since the warp, which is the more valuable portion of the web, was always made of linen yarn. The cotton business, therefore, of Manchester, till Arkwright furnished it with cotton water-twist for warp, in lieu of linen-yarn, was a mongrel manufacture, and should hardly be admitted to form an integral part of a history of the cotton trade; because any value assigned to it is

* See Note B at the end of the volume.

chiefly due to the flax constituent. The cotton weft was undoubtedly a yarn of a most irregular and indifferent quality, as we may infer from the urgency with which it was sought after, and the avidity with which it was bought up by the weavers from spinsters of every degree of skill.

Of the coarse quality of British cotton goods we have a remarkable evidence even so late as 1775, in a proposal then made in Scotland to enact a sumptuary law, or, failing that sapient scheme, to establish in Edinburgh a patriotic association, for the purpose of discouraging the ladies from wearing the cotton robes of India. "While the industrious inhabitants of Glasgow and Paisley were lately exerting themselves to improve, bring to perfection, and extend the manufactures of cambric and lawn, (flax fabrics,) the greater part of the women in Scotland were wearing muslin, a fabric of India; nay, so great is the influence of fashion, that the very wives and daughters of these men were wearing this exotic themselves! Surely we are void of thought!!!"* To counteract this absurdity in the Scottish ladies of wearing these foreign robes, because they were cheaper, more durable, and more becoming than their country-peoples' webs, a national society was proposed to be founded for shaming down these anti-patriotic habits in the ladies, and for black-balling all the gentlemen who should continue to keep company with the refractory fair in muslin raiment.

The first cotton goods of English make in which the warp was cotton were manufactured at Derby, in 1773, by Messrs. Strutt and Need, the partners of Arkwright, with some of his peculiar water-twist yarn.

* Gibson's History of Glasgow, p. 253.

But, after they had caused a considerable quantity of these genuine British calicoes to be woven, they discovered that an existing law, *for the encouragement of the arts,* imposed on such goods when printed double the duty of that chargeable upon mixed fabrics of linen and cotton. The same sapient law prohibited the sale of these home-made calicoes in the home market.

It required a long and expensive application to the Legislature to procure the repeal of these preposterous enactments. Such a composite web as that required by law could not take an uniform tint, on account of the unequal affinities which linen and cotton have for mordants and colouring matters, and therefore should never have been favoured with that impolitic preference, which undoubtedly obstructed the improvement of calico printing. It was probably meant to prevent the printing of Indian white goods for home consumption.

The following account of this Repeal Act, the 14 Geo. III. c. 72, will sound a little comical to English ears at the present day. "Whereas a new manufacture of stuffs made *entirely* of cotton spun in this kingdom has been lately introduced, and some doubts were expressed whether it was lawful to use it, it was declared by Parliament to be not only a lawful, but a laudable manufacture, and therefore permitted to be used, on paying 3*d*. a square yard, when printed, painted, or stained with colour."

While cottons remained a mixed fabric, the manufacture was altogether a domestic concern in this country, analogous to that of India. The workshop of the weaver was a rural cottage, from which when he was tired of sedentary labour he could sally forth into his little garden, and with the spade

or the hoe tend its culinary productions. The cotton wool which was to form his weft was picked clean by the fingers of his younger children, and was carded and spun by the older girls assisted by his wife, and the yarn was woven by himself assisted by his sons. When he could not procure within his family a supply of yarn adequate to the demands of his loom, he had recourse to the spinsters of his neighbourhood. One good weaver could keep three active women at work upon the wheel, spinning weft. It was found more easy to multiply weavers than spinsters, and hence looms were often at a stand for want of yarn.

These country weavers were sometimes put to great straits in fulfilling their contracts with the manufacturers of Bolton or Manchester, as they were usually bound under a penalty to return cloth by a stated day, commensurate with the web of linen warp which they had received. Things had continued to jog on in this precarious state for probably a century, with very little increase or amelioration of the processes, till about the year 1760. Then new marts of profitable export having presented themselves in Germany, Italy, and the North American colonies, the merchants became impatient of the delays and uncertainties in getting their orders executed. They saw and keenly felt that the only obstacle was the deficient supply of cotton weft, and they urged their weavers to greater diligence in pushing its production. At this time, says Mr. Guest, a weaver was under the necessity frequently of trudging three or four miles in a morning, and visiting many spinners before he could collect weft enough to keep his loom going during the rest of the day; and such was the competition he met with from other weavers engaged in the

enraged populace, who even threatened his life, he emigrated to Nottingham in 1768, where he found in Mr. Thomas James, a joiner, a partner willing and able to assist him in erecting a small spinning-mill upon the jenny plan. For this invention he obtained a patent in the year 1770, under the following title, "For a method of making a wheel or engine of an entire new construction, and never before made use of, in order for spinning, drawing, and twisting of cotton, and to be managed by one person only, and that the wheel or engine will spin, draw, and twist sixteen or more threads at one time, by a turn or motion of one hand, and a draw of the other." "One person," says he in the specification, "with his or her right hand turns the wheel, and with the left hand takes hold of the clasps, and therewith draws out the cotton from the slubbing (roving) box, and, being twisted by the turn of the wheel in the drawing out, then a piece of wood is lifted up by the toe, which lets down a presser wire, so as to press the threads so drawn out and twisted, in order to wind or put the same regularly upon bobbins which are placed upon the spindles."

Unfortunately for this inventor he had, under the pressure of poverty, mounted and sold several jennies before the date of his patent, so that when they were beginning to be rightly appreciated, and were promising to procure him a recompense somewhat proportioned to his deserts, he found, while his invention was extensively pirated by the manufacturers of Lancashire, that it could not be sustained in a court of law. In an evil hour also he refused to accept the sum of £3000 which the delegates of these manufacturers tendered to him for permission to use his machine; he demanded

a somewhat larger sum, which was refused, and eventually he got nothing, his attorney having abandoned the prosecution from a conviction that a favourable judgment would not be obtained in a court of law. Hargreaves died in 1778, a few years after this disappointment, but he did not fall a victim to poverty, as some have erroneously stated. The spinning factory of which he was a partner went on tolerably well, and enabled its author to live in humble comfort at least, and to leave a decent provision for his widow and children.

The jenny received some slight improvements, first from Hargreaves, and afterwards from other mechanicians; but, in fact, it is too simple a scheme of spinning to afford much scope for modifications. Crompton, the celebrated inventor of the mule, learned to spin upon one of the original jennies so early as the year 1769. The following figure and description will explain the construction of the jenny in its best state, and show that it is merely a many-spindled wheel upon the ancient wool-spinning principle, in which a definite length of roving is let out and extended during the revolution of the spindle, to which its end has been previously attached.

The spindles are seen to be arranged at one end of the frame, and the clasp or clove which holds the rovings, and which is equivalent to the left hands of several spinsters, is mounted upon a carriage, which moves backwards and forwards on a railway, to represent the backward and forward motions of the left arms of these spinsters.

The steel spindles, 3, 3, 3, stand upright, about three inches apart, at one end, A A, of the machine. Their

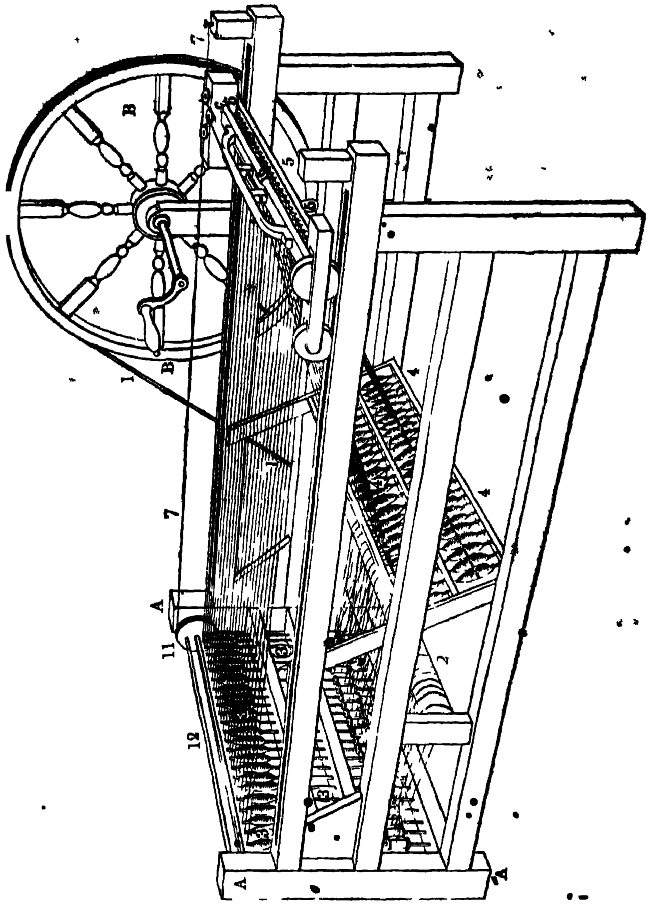

Fig. 15.—Hargreaves' Spinning Jenny in its most improved form.

lower ends are pointed and turn in hard brass steps fixed in a cross rail of the frame, and are supported near the middle of their height by passing through brass collars in another horizontal rail; a small pulley called a whorl, whirl, or wharf, is fixed on each spindle near

its bottom, to receive an endless cord, which passes round the horizontal cylinder or oblong drum, 2, of about six inches diameter; this drum is made of tin plate for lightness sake, is supported by pivots at its ends in the sides of the frame, and lies parallel to the row of spindles, so as to turn them all round together by transmitting a small band about each whorl. The drum is driven by a band, 1, 1, which passes round a pulley upon its end, and also round the great wheel B,B, fixed by means of a framing attached to the ceiling of the apartment. The wheel, B, is turned by applying the right hand of the spinner to the winch B, just as in the household wool-wheel, fig. 13.

In front of the spindles, and about a foot higher than their tips, a long horizontal cross rail, 16, is shown, supported at each of its ends in the wooden blocks, *c*, *c*, resting on friction wheels, to run on the railway, so that the rail or carriage, 16, can move horizontally forwards and backwards through a space of five, six, or, seven feet, without deviating in the least to the right or left, and therefore with a precision surpassing that of the hand-spinster's left arm. The under side of the cross bar or rail, 16, is notched to let the rovings pass through, which notches may be partially filled by projecting pieces upon the lower bar of the clasp, when this is raised to pinch the rovings preparatory to their elongation into threads. When the lower bar or jaw is let down the roving cord can pass freely through the notches. The rising and falling of the under rail is effected by small cords attached to it at every yard of its length, which pass over small pulleys sunk into the substance of the upper bar, 16, and run to a handle placed over the middle of

that bar, and beneath an arched bar fastened to the top of the clasp. The spinner holds this handle in his left hand, while with the right he turns the wheel, and with the fingers of the left hand he can lift the lower rail, 5, of the clasp, and draw it close to the upper one, where it is kept by a spring catch; when this catch is pushed back, the lower rail falls by its own weight, and, releasing the rovings, lets the proper length of them easily pass through for another draught of yarn.

The cops or bobbins of rovings to be spun are supported in the inclined frame 4, 4; they are mounted upon iron wires or skewers in two rows, one above the other, the number of cops in each row corresponding to half the number of spindles.

The spun threads are guided by the wire 12, when they are to be wound upon the spindles. This wire is attached to a horizontal rail, which turns at its two ends on pivots close to the row of the spindles, and it may be lowered so as to depress the thread to any level at the pleasure of the spinner by his pulling the cord 7, and turning round the pulley 11, which depresses the wire 12.

The jenny is worked by one person, male or female, who stands within the frame, and turns the wheel B with the right hand, whilst he holds the clasp in the left, so as to be able to run it backwards and forwards along its railway at pleasure. The rovings are drawn through between the bars or jaws of the clasp 16 and 5, the end of each being attached to its particular spindle. The clasp being open, its carriage is drawn backwards from the spindles till the requisite length of rovings has run freely through or be given out,

(as it was anciently between the finger and thumbs,) by being uncoiled from the balls or bobbins at 4. This length is regulated by a mark made on the frame of the machine, to indicate when the clasp carriage has arrived at its proper position; the jaws of the clasp are then made to close by raising the handle under the catch as above described, so as to pinch all the rovings. The spindles are now caused to revolve rapidly by turning the wheel B, at the same time that the carriage is drawn regularly backwards from them; thus twisting and extension go on simultaneously and in any proportion to each other, according to the relative actions of the right and left hands of the spinners; when the threads have gained their utmost length they receive a finishing twist to strengthen them, especially for warp-yarns. In order to wind up these threads they are pushed down upon their respective spindles by depressing the faller wire 12, during which movement the wheel B is made to revolve slowly, in order to wind the thread regularly upon the spindles, in proportion as the clasp-carriage is moved towards them; as soon as the carriage has got home one series of threads is finished, and another series is begun by an operation similar to the preceding.

"The wooden or tin roller or drum 2, and the vertical wheel B, were not," says Mr. Kennedy, "of Hargreaves' invention, but were introduced into the jenny by one Haley, of Houghton Tower, a few years after the invention had been made."

In Hargreaves' original jenny-frame the *presser wire* which distributes the yarn over the spindle into a shapely cop was connected by a cord going over a pulley to a piece of wood, which was lifted up by

winding upon the bobbin by the difference between its velocity and that of the spindle. When the thread has been wound for some time upon the bobbin opposite to the point *g*, it is shifted to another hook or tooth on the flyer, so as to distribute it evenly along the whole barrel. When the bobbin is filled, it is replaced by an empty one. The fingers of the two hands are employed principally to equalize the distribution of the filaments, and to remove entanglements; while those of the hand next to the spindle at *b*, by holding the thread in some measure against the traction of the winding-bobbin, serve to stretch and attenuate it to the requisite degree. The skill of the spinster is estimated by the uniformity, strength, and fineness of the thread.

It is by a process similar to the above, in which textile filaments are equally extended and twisted by almost imperceptible gradations, that good thread can be formed; but to represent or realize these actions of tact and intelligence by machinery seems at first sight an impossible problem.

Inventions in the useful arts commonly spring from necessity, and advance by slow degrees from rudeness to refinement. Attempts have been recently made to prove that machine-spinning is an exception to this general conviction of mankind, that it was invented by an individual remote from the bustle of textile industry, and by him produced at once in a state of relative perfection. Mr. Guest, in his indefatigable zeal to pluck the laurels of fame from Arkwright's brow, has brought to the day an apparently startling document, long buried among the musty archives of Chancery. This is a patent *for spinning wool and cotton by rollers*,

obtained in the year 1738 by Lewis Paul, of Birmingham. This invention, however, appears from other evidence to belong principally to Mr. John Wyatt, an ingenious gentleman then residing in the same town. The following is the essential part of the specification:

"The wool or cotton being thus prepared (by carding into slivers), one end of the mass, rope, thread, or sliver, is put betwixt a pair of rowlers, cillinders, or cones, or some such movements, which being twined round by their motion, draws in the raw mass of wool or cotton to be spun in proportion to the velocity given to such rowlers, cillinders, or cones. As the prepared mass passes regularly through or betwixt these rowlers, cillinders, or cones, a *succession* of other rowlers, cillinders, or, cones moving proportionably faster than the first, draw the rope, thread, or sliver, into any degree of fineness which may be required. Sometimes these successive rowlers, cillinders, or cones (but not the first) have another rotation besides that which diminishes the thread, yarn, or worsted, viz., that they give it a small degree of twist betwixt each pair, by means of the thread itself passing through the axis and center of that rotation. In some other cases only the first pair of rowlers, cillinders, or cones, are used, and then the bobbyn, spole, or quill, upon which the thread, yarn, or worsted is spun, is so contrived as to draw faster than the first rowlers, cillinders, or cones give, and in such proportion as the first mass, rope, or sliver is proposed to be diminished."

The action of rollers in laminating, drawing, and attenuating metallic bars, rods, and plates, has long constituted a leading feature in the workshops of Bir-

mingham, and obviously suggested the plan described in the above specification,—a plan altogether fantastic, absurd, and unmanageable for the spinning of wool, cotton, or any other textile filaments. "The soft cord or sliver, after escaping from betwixt the first pair of rowlers, passes through a *succession* of other rowlers moving proportionably faster, so as to draw the rope into any degree of fineness." This succession implies clearly a series of several pairs of rollers—a complexity of construction and movement which never existed but in the brain of the patentee, impracticable with his means, and utterly destructive to woolly fibres had it been practicable. It will appear from subsequent evidence that this succession of rollers moving with successive velocities was merely a fine phrensy of imagination, and was never carried into effect. But the next member of the description exceeds in absurdity any thing to be found upon the specification rolls,—being a self-evident impossibility. "Sometimes these successive rowlers (not the first) have another rotation besides that which diminishes the thread, viz., that they give it a small degree of twist betwixt each pair by means of the thread itself passing through the axis and centre of that rotation." As the thread was inevitably pinched at two points, viz., between the first pair and last pair of rollers, any twisting of its intermediate parts was manifestly impossible. But we may ask any mechanic what rotation such a *roller* could have, besides the rotation upon its axis, which diminishes the thread; or how could the thread be made to pass through the axis and centre of that rotation without being instantly torn to atoms? The expression here used "betwixt each pair" insinuates

the existence of several successive pairs of rollers, all endowed with these impossible motions and functions; circumstances introduced either for the purpose of mystifying common minds, or derived from some vertiginous movements of the brain.

The last sentence, like the postscript of a lady's letter, contains the whole substance of the invention;—a pair of flatting rollers prefixed to the spindle and bobbin of a spinning-wheel; an ingenious fancy, no doubt, but not a mechanism capable, under any modification, of converting a carded sliver of wool or cotton into tolerably good yarn. Mr. Kennedy, a great authority among cotton-spinners, pronounced the following opinion upon a sample which had been spun by Mr. Wyatt's roller machine. "From examining the yarn I think it could not be said by competent judges that it was spun by a similar machine to that of Mr. Arkwright; for the fabric or thread is very different from the early production of Mr. Arkwright, and is, I think, evidently spun by a different machine, the ingenuity of which we cannot appreciate, as the model mentioned in the paper alluded to is unfortunately lost."*

Any one may readily conceive that yarn spun by the simultaneous drawing and twisting of a sliver delivered in a thick mass by one pair of rollers could not be level, but lumpy, very different from, and very inferior to, yarn spun by the twisting and drawing of an evenly-attenuated fine-roving of parallel filaments.

The specimen on which Mr. Kennedy gave judgment had been spun on "the spinning-engine without

* On the Rise and Progress of the Cotton Trade, in the Memoirs of the Manchester Society. 2d Series, vol. iii. p. 137.

hands," of Mr. Wyatt, about the year 1741; the engine being turned by two (or more) asses, walking round an axis in a large warehouse, near the well in the Upper Priory, at Birmingham.

From a manuscript journal of Mr. John Wyatt, obtained by Mr. Kennedy from the son of the ingenious and unfortunate patentee of the above engine, it appears that a spinning factory upon his plan had been established at Northampton about the same time, of which Mr. Cave, editor of the *Gentleman's Magazine*, so well known by Dr. Johnson's eulogy of his benevolence, was the proprietor. This factory consisted of several spinning-frames, containing altogether 250 spindles and bobbins, each of which was moved by a separate wheel and pinion, the one having sixty-four teeth and the other sixty-five, on purpose, no doubt, to cause the winding-on motion by the difference in velocity of the spindle and bobbin,—the whole being driven by a water-wheel.

Mr. Wyatt seems to have spent much of his time in London, inquiring into the prices of yarns, leaving the factory at Birmingham to be managed by Paul. He visited Mr. Cave's factory at Northampton in October, 1743, and wrote a number of remarks upon it, most probably for the information of that gentleman. Among others, he states that the agent, his wife, and two other women to assist him, received altogether a salary of £88 per annum,—a sum which would seem to imply superior merit in the agent, especially when it is compared with the wages of the other workpeople; for fifty carders, spinners, and supernumerary girls in the work, received for one week's wages £3, being only about 1*s.* 2*d.* apiece.

An interesting notice of Mr. Wyatt's contrivances for spinning cotton was published by his son, Mr. Charles Wyatt, in the *Repertory of Arts, Manufactures, and Agriculture*, for January, 1818, of which his brother, Mr. John Wyatt, was then editor. The following extracts contain the substance of the communication.

"In the year 1730, or thereabouts, living then at a village near Litchfield, our respected father first conceived the project, and carried it into effect; and in the year 1733, by a model of about two feet square, in a small building near Sutton Coldfield, without a single witness to the performance, was spun the first thread of cotton ever produced without the intervention of the human fingers, he, the inventor, to use his own words, '*being all the time in a pleasing, but trembling, suspense.*' The wool had been carded in the common way, and was *passed between two cylinders, from whence the bobbin drew it by means of the twist.*

"This successful experiment induced him to seek for a pecuniary connexion equal to the views that the project excited, and one appeared to present itself with a Mr. Lewis Paul, which terminated unhappily for the projector; for Paul, a foreigner, poor and enterprizing, made offers and bargains which he never fulfilled, and contrived, in the year 1738, to have a patent taken out in his own name for some additional apparatus, a copy of which I send you; and in 1741, or 1742, a mill turned by two asses walking round an axis was erected in Birmingham, and ten girls were employed in attending the work. Two hanks of the cotton then and there spun are now in my possession, accompanied with the inventor's testimony of the performance. Drawings of the machinery were sent, or

appear to have been sent, to Mr. Cave, for insertion in the *Gentleman's Magazine*.

"This establishment, unsupported by sufficient property, languished a short time, and then expired; the supplies were exhausted, and the inventor much injured by the experiment, but his confidence in the scheme was unimpaired. The machinery was sold in 1743. A work upon a larger scale, on a stream of water, was established at Northampton, under the direction of a Mr. Yeomen; but with the property of Mr. Cave. The work contained 250 spindles, and employed fifty pairs of hands. The inventor soon after examined the state of the undertaking, and found great deficiency and neglect in the management. At that time they had spun about 3,300 lbs. of cotton. On the observations which he then made he composed what he entitled *A Systematic Essay on the Business of Spinning*, which exhibits a clear view of the mechanical considerations on which an undertaking of that nature, of whatever magnitude, must be established, and apparently confines his humble pretensions to the profits on 300 spindles. It was not within human foresight to calculate the richness of the harvest to come from this little germ.

"This brings me to the conclusion of our father's connexion with the spinning business. • •

"The work at Northampton did not prosper. It passed, I believe, into the possession of a Mr. Yeo, a gentleman of the law, in London, about the year 1764, and, from a strange coincidence of circumstances, there is the highest probability that the machinery got into the hands of a person who, with the assistance of others, knowing how to apply it with skill and jud-

ment, and to supply what might be deficient, raised upon it, by a gradual accession of profit, an immense establishment, and a princely fortune.

"In the year 1739, my father writes to one of his friends, '*that by this method*,' some new thought, '*the wool need be no more carded than to break the knots or mix it well, as with scribbles or stock cards, and being thus mixed and pressed down hard into a box, it may without any human touch be picked out almost hair by hair, and made into yarn.*'

"In 1748 Mr. Paul procured another patent, the title of which was for 'carding of wool and cotton,' but whether this was combined with the machinery then at Northampton, or where it was introduced, I know not. Such, or nearly such, being the early history of this invention, I thought the late Sir Richard Arkwright would be gratified by possessing the very model to which I have alluded, and I accordingly waited on him at Cromford with the offer, but my reception did not correspond with my expectations.

"To pretend, however, that the original machinery, without addition or improvement, would alone have produced the prodigious effects which we now behold, would be claiming improbable merit for the inventor, and degrading the talents and sagacity of his successors in the same field of enterprize, for it cannot be denied that a great fund of ingenuity must have been expended in bringing the spinning works to their present degree of perfection. The number of spindles now in use is supposed to exceed 5,000,000.

"If the author of the humble establishment at Bir-[illegible]m gave birth to such a wonderful progeny, he [illegible]st to be acknowledged as a benefactor to

his country, and recorded amongst the men who, from an attachment to the science and practice of mechanics, open the paths of knowledge, and point out, but do not pursue, those which lead to profit and prosperity

"Connected with this subject I might with great propriety point out many eminent services that he rendered the public by his mechanical talents; but being mostly local, and absorbed by subsequent productions, they have lost their present interest.

"The machine, however, for weighing loaded carriages, coal particularly, ought to be distinguished as one of known and extensive utility. It was solely and exclusively his own; he erected the first at Birmingham about 50 years ago, and his own description of it is, '*That it would weigh a load of coal, or a pound of butter with equal facility, and nearly with equal accuracy.* The present makers admit that the principle is incapable of improvement.

"The late Mr. Boulton, a man too eminent and too amiable to be mentioned without esteem and regret, nor on my part without affection, set a high value on my father's attainments and virtues, for it was universally acknowledged that he had the happiness to give a lustre and an interest to his genius and his knowledge by the purest probity, the most unaffected humility, urbanity, and benevolence. He was attended to the grave in 1766 by Mr. Boulton, Mr. Baskerville the celebrated printer, (who, from the peculiarity of his notions, arrayed himself on this occasion in a splendid suit of gold lace,) and four other gentlemen of eminence in Birmingham."

This vindication of his father's fame, while it is highly honourable to the heart of the writer, shows that the

original plan of Wyatt was to employ a pair of rollers for delivering, at any desired speed, a sliver of cotton to the bobbin-and-fly spindle, as in a flax-wheel. Then onsensical mystification of a succession of other "*rowlers*," and another rotation besides that which diminishes the thread, appears to have been introduced into the patent of 1738 by Lewis Paul, and never existed nor could exist in any machine.

The delivery-roller principle of Wyatt reappeared by itself in Paul's second patent of 1758. "The several rowes or filaments so taken off (the flat cards) must be connected into one entire roll, which being put between *a pair* of rollers or cylinders, is by their turning round *delivered* to the nose of a spindle, in such proportion to the thread made, as is proper for the particular occasions. From hence it is delivered to a bobbin, spole, or quill, which turns upon the spindle, and which gathers up the thread or yarn as it is spun. The spindle is so contrived as to draw faster than the rollers or cylinders give, in proportion to the length of thread or yarn into which the matter to be spun is proposed to be drawn."

This specification is identical with the concluding paragraph of the former, and therefore afforded no valid claim to new letters patent. In the first, the card-rolls were joined together into a kind of rope of raw wool; in the second, the several rows (of cardings) *must* be connected into one entire roll. The two patents are therefore entirely the same. The second is remarkable for the renunciation of the fantastic whim of successive rollers with certain whirligig inexplicable motions which cuts so conspicuous a figure in the first, and which was put there, like the Martello

towers on the Irish coast, for the purpose of puzzling posterity. The equable extension and attenuation of the thread by means of a pair of feeding-rollers, a pair of carrying-rollers, and a pair of drawing-rollers, cannot be traced in the preceding rude scheme, and they constitute the very essence of roller-spinning.

No wonder the work at Northampton did not prosper, since Paul, with an experience of more than twenty years, aided during a part of the time by the sagacity of Wyatt, had never been able to spin with all his roller-apparatus a single good thread. Had the yarn spun in the factory under him or Mr. Yeo, from the year 1748 to 1764, been but tolerable, it would have commanded a rapid sale, and secured to them large profits.

The use of *delivering*-rollers as heretofore exhibited, so far from helping an inventor into a right system of spinning, would most probably mislead him, and induce him to try various modifications of so plausible a scheme, instead of abandoning it altogether. This was exactly the dilemma of Paul, who appears from his carding patent of 1748 to have been a man of much ingenuity, and a good practical mechanic. He has an incontestable claim to the invention of the cylinder-card, an engine which plays one of the most important parts in a modern factory. Of this elegant contrivance some particulars will be mentioned in treating of the preparation-machines of a cotton-factory. If Mr. Charles Wyatt had studied more deeply the principles of cotton spinning, he would never have confounded a single pair of delivering-rollers, with a double or triple pair of drawing-rollers, nor would he have felt surprise at his indifferent reception from Arkwright,

when his errand was to tell the great master-spinnner of the age, that two things in his art so essentially unlike, were the same. Paul's carding invention, in fact, however valuable in preparing cotton for a good system of spinning, became nugatory to himself and his partners, by being linked to his vicious roller plan, which rendered the industry of his whole life unproductive, and plunged him, it is believed, in eventual ruin.

The three patents of 1738, 1748, and 1758, appear to have been much talked of at the time in the manufacturing districts; both Wyatt and Paul having done what they could to make them generally known, and to interest the world in their behalf. In the years 1739, 1740, 1741, 1742, and 1743, Mr. Wyatt was resident chiefly in London, visiting the principal manufacturers of cotton goods, who then worked up East India yarns, purchased at a high price; and he endeavoured, but apparently without success, to dispose of his machine-spun yarn to them. It is quite certain that if its quality had been merely tolerable, it would have commanded a ready sale and a remunerating price. He also paid a fruitless visit to Lancashire on the same errand. The machine was so radically bad that its two schemers, after working upon it the best part of their lives, from 1730 till 1764, let it drop into the hands of Mr. Yeo, a gentleman of the law, in London, who became proprietor of Paul's water-power spinning factory at Northampton, and who, finding it a hopeless concern, caused it to be dismantled. The disastrous result of roller-spinning being thus universally promulgated, would naturally deter prudent men from attempting to revive it. Supposing, therefore, that Arkwright, or any other person had got pos-

session of the whole of Paul's roller-machines, could he have made more of it than the baffled patentees had done? Indeed, the spinning project of Wyatt and Paul, instead of being instrumental to the construction of a rational roller system, must have proved the greatest bstacle to its contrivance, and made it be looked upon by men of business as a folly, with which it would be dangerous to have anything to do.

The grand mechanical problem which the cotton manufacture then offered to the solution of the ingenious may be stated as follows: To construct a machine in which one member should supply continuously and uniformly porous cords of parallel filaments in minute portions: a second member should attenuate these cords by drawing out their filaments alongside of each other by an imperceptible gradation; a third member should at once twist and extend these attenuated threads unremittingly as they advance; and a fourth should wind them regularly upon bobbins exactly in proportion as they are spun. When contemplated *a priori* in its delicate requirements, this problem must have appeared to be impracticable; a conviction strengthened by the total failure of Wyatt and Paul to produce good yarn, even at the highly remunerating price of that time. Their rank in the history of roller-spinning may be justly compared to that of the Marquis of Worcester in the history of the steam-engine—they gave birth to an idea which was quite erroneous for practical purposes, and which, being pursued, did, and could, produce nothing but disappointment and ruin to its authors, a result most unpropitious to the progress of invention in any line of industry.

That the roller-spinning scheme was one of common notoriety in Lancashire about the year 1766 appears from the evidence of the clock-maker, Kay, on the trial of Arkwright's patent in the Court of King's Bench, on the 25th of June, 1785. Kay lived at Warrington in 1767, when he first became acquainted with Mr. Arkwright.

"We were talking," Arkwright and he, "of different things, and this thing came up of spinning by rollers. He (Arkwright) said, that will never be brought to bear, several gentlemen have almost broke themselves by it." The testimony of this man must, no doubt, be taken with reserve, for when Arkwright returned next morning to Kay, and asked him (he says) if a roller-spinning model could be made at a small expense? "Yes," says I, "I believe, I can. Says he, if you will I will pay you." Thus, when Kay undertook this job for Mr. Arkwright, he made no mention of Thomas Highs, to whom, however, on the trial, in 1785, he ascribed the invention of the plan of drawing-rollers. He merely said, "I and another man have tried that method in Warrington." On the contrary, it transpires from Kay in the course of his examination by the same lawyer, that he had assumed to himself the original property of the drawing-roller invention, and no doubt availed himself, as far as he could, of the credit of it, to raise his reputation as a workman. When questioned, as follows, by Mr. Lee, "You must know whether at that time (1775) it was his own (Arkwright's) invention, or he had it of you," he replied, "James Hargrave told me I should have lodged a caveat."* What inference can

* This passage of the examination is quoted by Mr. Guest, at p. 65 of his *Compendious History of the Cotton Manufacture*. 4to. London, 1823.

be drawn from this advice of Hargrave, who, being a conscientious man, would not recommend an act of knavery, than that Kay had represented himself in the year 1775, after being long a working mechanic in Arkwright's pay, as the real inventor of the drawing-rollers, which his other testimony proves that he was not. Had the leading lawyers of that day been as well versant in manufacturing subjects as they are now, the evidence of Kay would have been entirely set aside. In fact, the above awkward admission, though quite fatal to his character for truth and fair dealing, is in perfect keeping with the circumstances of his absconding from Arkwright's employment with a charge of felony at his heels. Mr. Arkwright, amid the multiplicity of his concerns, did not choose to prosecute the charge against the miserable offender, who had fled to Ireland.

In the above-mentioned trial in the court of King's Bench, Thomas Highs, by trade a reed-maker, was brought forward to prove that he was the real inventor of the drawing-roller plan of spinning for which Arkwright had obtained a first patent in 1769, and a second patent, of a more complete and comprehensive nature, in 1775.

The testimony of Highs is extremely indistinct and confused, very unlike that of a man who had invented a really operative mechanism. He does not indeed pretend to have ever made a machine capable of doing work, but merely to have got Kay, the clock-maker, in 1767, to put together a slight toy containing two pairs of smooth wooden rollers, of which the one pair was to move five times quicker than the other.

" *Q.* (Mr. *Sergeant Bolton.*) I will take him to the

rollers: you see one is fluted, the other covered with leather. Was yours the same way?—*A.* Yes, mine was, two years after (after 1767) but not then.

Q. Not at first?—*A.* No.

Q. In 1769 yours were like it?—*A.* They were; mine had fluted work; fluted wood upon an iron axis; but the other roller was the same, only it was covered with shoe-leather, instead of that leather; *I am informed it is such as they make shoes of.*

Q. Whom did you employ when you first conceived this invention; whom did you employ to make it for you?—*A.* I employed one Kay, who came from Warrington.

Q. What trade was he?—*A.* He followed clock-making at that time. I employed him to make a small model with four wheels of wood to show him the method it was to work in, and desired him at the same time to make me brass wheels, that would multiply it about five to one.

Q. Who made you the wheels?—*A.* I made them myself."

When asked when and where he applied his rollers to roving and spinning, he replied, "In the town of Leigh. I did not follow this new manufacture; I was only improving myself, as I had a large family at that time, and was not able to follow it. I thought when I came a little abler, when I should get a friend to assist me; being poor, and having a large family; I was not willing any body should steal it from me."*

Highs shows himself here a sorry driveller, who had neither appreciated, nor tried to mature, the plan of

* Guest's *Compendious History*, p 57.

drawing-rollers, supposing him to have schemed something of the kind, and which after the general talk about roller-spinning was a matter of no great merit. From anything which appears, however, Arkwright may have invented the drawing-rollers himself; for the testimony of Kay, a double-minded man, in open hostility with his late master, cannot be admitted to be of any weight. Highs swears, first, that the multiplying wheels of his model were made by Kay, and in a little after he swears, they were made by himself. Surely a person like Highs, so jealous of his little contrivances as to lay them aside rather than perfect them for fear of their being stolen from him, if he could have made these multiplying brass wheels, never would have employed a clock-maker to construct them for him, and more especially the wooden rollers which were far more easily made. Kay says, he made at the above period two roller models for Arkwright, the one a fortnight after the other, the last of which Arkwright took with him to Preston, the place of his residence.

Highs does not appear to have acted as the author of a valuable machine for spinning, so much sought after then, would have done; for in the year 1772, five years after his pretended invention of drawing-rollers, he was occupied in constructing an engine of a totally different description for a gentleman in Manchester, and met Arkwright there in a social manner at a tavern, without showing any symptoms of that indignation which an inventor would have naturally displayed against the plunderer of his genius. He told Arkwright, indeed, that he never would have had the rollers but for him, but he does not appear to have either thought, or done, anything more about them, in that most stirring

birth-day of the cotton manufacture. Had he possessed such a high character for mechanical ingenuity in Lancashire as has been affirmed by Mr. Guest, surely he might easily have found capitalists willing and able to patronize so useful an invention as that of spinning-rollers, had it been at all in a feasible form.

The great achievement of manufacturing good yarn by rollers was reserved for the sagacity and energy of Arkwright. This illustrious individual, persecuted and calumniated as all the signal benefactors of corrupt and invidious humanity have been, by contemporary rivals, was raised up by Providence from an obscure rank in life, to vindicate the natural equality of men. He was born at Preston, in Lancashire, on the 23d of December, 1732, the youngest of thirteen children, and received a very imperfect education. He was bred to the trade of a barber, which, being still incorporated with surgery in many towns, and deriving much profitable employment from the making of wigs, then worn by all people of condition, was no despicable vocation. Nor was he a mean or common-place practitioner of his art, for he became skilled in a superior process for dyeing hair, still one of the nicest operations of chemistry. According to the testimony of Mr. Richardson, hair-dresser of Leigh, the hair furnished by Arkwright was esteemed the best in the country.* In the purchase and sale of this valuable article he had occasion to travel a great deal, and being of an inquisitive mind became well acquainted with the necessities under which the cotton trade then laboured from a precarious supply of cotton-weft, and a total

* Communicated to Mr. Guest by Mr. Richardson. See "*Compendious History*, p. 21.

want of cotton-warp yarns. He appears to have been curious in mechanical combinations, and was, along with many other ingenious men in that dawn of rational mechanics, intent upon the discovery of the perpetual motion, for he employed the clock-maker Kay to make some brass wheels subservient to that project. This impossible problem, like that of the philosopher's stone, by exercising invention in endless shapes, gave birth to many discoveries. The evidence of his enemy Kay is conclusive on this point. It is probable, however, that Arkwright, aware of the importance of the spinning apparatus, which he was then concocting, may have disguised the purpose of his wheels under the name of a perpetual motion. Having realized the outline of his idea of drawing-rollers in a little model, made by Kay in 1767, he applied immediately to Mr. Atherton, a mechanist, then of Warrington and afterwards of Liverpool, to assist him in mounting a working machine upon the same plan. This gentleman declined taking any share in so hazardous an enterprize, as roller-spinning was then naturally held to be, after the failure of Wyatt and Paul, but he sent him two workmen, a smith and a watch-tool maker, to aid Kay in the construction of his apparatus. "In this way Mr. Arkwright's first engine, for which he afterwards took out a patent, was made."*

This straight-forward expedition in constructing a complex machine, affords unquestionably a conclusive proof that Arkwright must have thoroughly matured his plan of a drawing-roller frame before he ever called upon Kay, and that he employed this workman partly on account of his reputation as a clever clock-

* Aikin and Enfield's *General Biography*.

maker, but chiefly from his living at a distance from Bolton, where Arkwright resided, and where he would not wish any hints of his project to transpire.

The operative model being thus rapidly completed, the vigorous mind of the inventor did not delay an instant to verify its powers; but, repairing to Preston, his birth-place, he found among the companions of his early life one ready to assist him with heart and hand, Mr. John Smalley, a liquor-merchant and painter. This friendly man procured the use of the parlour of *the house belonging to the Free Grammar School of that* town, in order that Arkwright might fit up and work his spinning-frame. Being convinced by the trial, of its utility, they resolved to get other machines constructed on a still greater scale; but aware of the riots which had recently occurred at Blackburn against the spinning-jenny, the contemporaneous contrivance of James Hargreaves,—they resolved to abandon their native county, then under violent fermentation.

The stocking frame of Lee had long afforded a method of making silk and worsted stockings by mechanism, much more beautiful and at a cheaper rate than the hand-knitter could do. But the manufacture of *cotton* hosiery, though highly prized, had hitherto languished for want of proper yarn. Hargreaves, and especially Arkwright, saw in their respective inventions, the means of supplying this much-wanted article, and accordingly they both in succession commenced their career in Nottingham, then, as still, the head quarters of the frame-work knitting trade. Messrs. Smalley and Arkwright applied to the Messrs. Wright, the eminent capitalists and bankers of that town, who readily joined in the enterprize. After a little time,

however, finding that the results of the machinery were not so advantageous or promising as they had expected, they took alarm, having the disasters of Northampton before their eyes, and withdrew from the concern. They introduced Arkwright in this new dilemma to Mr. Samuel Need, a considerable manufacturing hosier of Nottingham, who had for a partner that eminent mechanician and excellent man Mr. Jedediah Strutt, of Derby, the inventor of the only capital improvement ever made on Lee's stocking frame, that for making ribbed stockings, still named, from his place of residence, the Derby rib. Mr. Strutt discerned at once the sound principles of Arkwright's machine, and frankly declared his conviction that, with some slight mechanical adjustments, it would spin excellent hosiery yarn—the greatest desideratum in the cotton manufactures of that day; since the common hand-wheel yarn, as well as the jenny-yarn of Hargreaves, was too soft and loose for making good stockings.

Being now associated with capitalists of probity and enterprize, Arkwright tasked his faculties of mind and body to their utmost stretch to organize more completely the factory at Nottingham, which, with the aid of Smalley and Messrs. Wright, he had mounted so early as 1768, and driven by horse-power. On the 3d July, 1769, his first patent is dated, a year ever memorable also in the annals of industry for the patent invention of James Watt. In the following year, 1770, he was joined by Messrs. Need and Strutt. In 1771, this admirable triumvirate selected an excellent factory site at Cromford on the Derwent, where they erected the first water-spinning-mill,—the nursing-place

of the factory opulence and power of Great Britain. Here still may be seen at work the original frames of the inventor,—proofs demonstrative, were any wanted by the candid philosopher, that Arkwright was no plagiarist of other men's ideas, since he had then created a grand productive automaton, unlike everything else on the face of the earth. But many years of indefatigable labour passed over the inventor's head before the system was completed to his mind,—scarcely a week being barren of some valuable improvement. "About the years 1772 and 1773," says Mr. Guest, "his (Arkwright's) attempts at spinning had excited considerable interest in Leigh from his being so well known there, and it was common for the respectable inhabitants of the place to go and view his engines (at Cromford) and buy a dozen or two of pairs of stockings, made of yarn spun by them. I have in my possession a pair of stockings so bought at that period."*

"It seems that he (Highs) and Arkwright happened to be both in Manchester at that time (1772,) and that one Mr. Rothwell brought them into company together, in the parlour of a public house in that town, (Highs was then making an engine for a gentleman in Manchester, for which he received a premium,) and their conversation turned upon engines. He deposes that he told Mr. Arkwright he had got his, the witness's invention."† "In 1770 or early in 1771, he (Highs) removed from Leigh to Camp Street, Manchester, where he constructed what may be termed a double jenny. This had twenty-eight spindles on each side, which were turned by a drum or roller placed in the centre. This

* *The British Cotton Manufactures*, by Richard Guest. Manchester, 1828, p. 15.

† Ibid. p. 29.

machine was publicly worked in Manchester Exchange in 1772, by his son Thomas Highs, then about ten years of age, and the manufacturers on that occasion, subscribed 200 guineas, and presented them to Highs as a reward for his ingenuity."* "In 1773, he removed to Bolton-le-Moors where he resided until 1776. In 1776, he returned to Manchester. In 1778 and 1779, he made machines at Kidderminster for various manufacturers, among others, Messrs. Pardoe, Lea, and Co."†

Such is Mr. Guest's account of Highs, at the most critical period of Arkwright's grand invention. If the drawing-rollers patented by Arkwright, at first in 1769, and, a second time in 1775, for spinning cotton, had been the invention of Highs, they never could have remained for one month in the state of a monopoly, since Highs was in the very focus of the cotton manufactures at Manchester, in high favour, and in confidential relations with the leading manufacturers of that district. The people of Leigh, on their return from their visit of wonder at Cromford, would have all risen in arms against the usurper of their townsman's invention, and have interested the public in his behalf provided there had been any good foundation for his claims. The spirited inhabitants of Manchester would not have suffered the ingenious man to whom they awarded so handsome a premium for doubling the jenny, to be robbed of another invention of far greater importance nor would they have failed to place him at once in the foreground of an attack upon Arkwright's patents. Priority of invention is so much more definite a plea than obscurity of description, in attacking a patent in a

* *The British Cotton Manufactures*, by Richard Guest. Manchester, 1828, p. 203.

† Ibid. p. 205.

court of law, that if Highs of Leigh, a well-known and much-esteemed machine maker, in Manchester, had originally contrived a practicable set of drawing-rollers, he would have been able to exhibit them to his friends and admirers, and to have strangled Arkwright's patent in the very birth.

Round every schemer "much embryo, much abortion lies." That Highs had entertained a vague notion of drawing out cotton filaments by two pairs of rollers, one pair moving faster than the other, is possible; but it is certain from the above circumstances, that he had never realized it in anything of a workable form. I conclude, therefore, that the merit of a rational system of spinning and roving by rollers is entirely due to Arkwright, and that but for his high mental qualities, sagacity, decision, and his unwearied activity, the water-twist frame, with its offspring the throstle and mule, might not for ages have ennobled the industry of England.

It appears from the testimony given by Kay at the trial in 1785, that after he entered into the service of Arkwright, he left Warrington, and accompanied his master to Manchester, where he was employed by him for thirteen weeks in making a clock. Arkwright had occupied himself, we have seen, with the problem of the perpetual motion, and had no doubt studied with that view various kinds of clock movements. With a mind full of the project of roller-spinning, immediately after trying the model at Preston, would such a pushing man as Arkwright have employed his mechanic at high wages for thirteen weeks, in making an ordinary clock? No surely. He must have had some peculiar scheme of wheel-work for the measurement of time,

which he set Kay to work in realizing. After this experimental job was finished, Kay did nothing more for Arkwright, till he joined him and Smalley at Nottingham, for the purpose of co-operating in their factory-spinning enterprize.

As Mr. Arkwright had thus evidently directed his attention to clock-making, and naturally enough supposed himself the author of some improvements in that art, he chose to designate himself clock-maker in the drawing-roller patent of 1769, a very pardonable assumption, since he might have impaired his credit as the patentee of complex machinery, by appearing under the designation of a handicraft which he had now for ever renounced.

The specification of this patent is remarkably perspicuous. It mentions every essential element of a good water-twist or throstle-spinning machine of the present day, and is therefore in perfect accordance with the fact already stated, that some of the original spinning water-frames of Sir Richard Arkwright are still spinning good yarn at Cromford, the wooden teeth of the wheels and pinions having ground themselves into the best shapes for diminishing friction. In the preamble of the specification, dated 15th July, he truly says, that he "had by great study and long application invented a new piece of machinery, never before found out, practised, or used, for the making of weft or yarn from cotton, flax, and wool; which would be of great utility to a great many manufacturers, as well as to his Majesty's subjects in general, by employing a great number of poor people in working the said machinery, and by making the said weft or yarn much superior in quality to any heretofore manufactured or made."

To no patent ever granted by a sovereign, could the above enunciation be with so much propriety prefixed. The following are his figure and description.

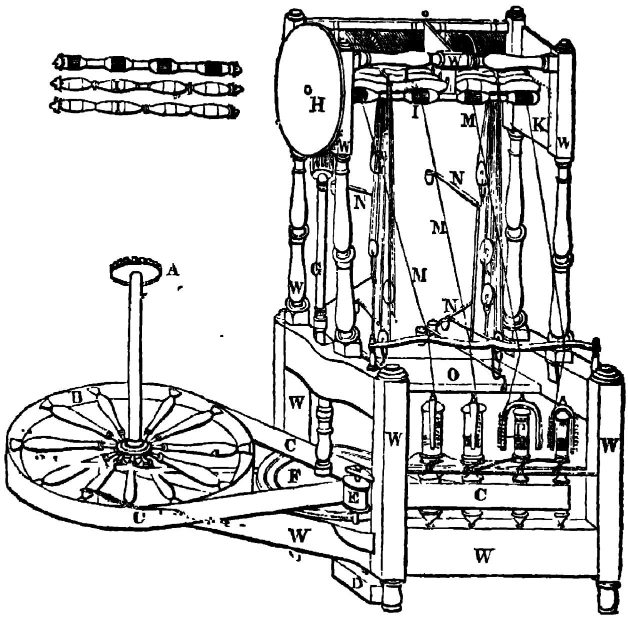

Fig. 18.—Arkwright's original patent Water-frame Spinning Machine of 1769.

"Now know ye that I, the said Richard Arkwright, do hereby describe and ascertain the nature of my said invention, and declare that the plan thereof drawn in the margin of these presents is composed of the following particulars, (that is to say). A, the cog wheel and shaft, which receive their motion from a horse. B, the drum or wheel which turns C, a belt of leather and gives motion to the whole machine. D, a lead weight which keeps F, the small drum steady to E,

the forcing wheel. G, the shaft of wood which gives motion to the wheel H, and continues it to I, four pairs of rollers, (the forms of which are drawn in the margin,) which act by tooth and pinion made of brass and steel nuts fixed in two iron plates, K. That part of the roller which the cotton runs through is covered with wood, the top roller with leather, and the bottom one fluted, which lets the cotton, &c., through it; by one pair of rollers moving quicker than the other draws it finer for twisting, which is performed by the spindles T. K, the two iron plates described above. L, four large bobbins with cotton rovings on, conducted between rollers at the back. M, the four threads carried to the bobbins and spindles by four small wires, fixed across the frame in the slip of wood V. N, iron levers with small lead weights hanging to the rollers by pulleys, which keep the rollers close to each other. O a cross piece of wood to which the levers are fixed. P, the bobbins and spindles. Q, flyers made of wood, with small wires on the sides which lead the thread to the bobbins. R, small worsted bands put about the whirl of the bobbins, the screwing of which tight or easy causes the bobbins to wind up the thread faster or slower. S, the four whirls of the spindles. T, the four spindles which run in iron plates. V, explained in letter M. W, a wooden frame of the whole machine.

There is no doubt that the above figure, as given in with the specification in 1769, is an exact portraiture of the model made at Warrington by the aid of Atherton's workmen, which was set up and tried in the schoolmaster's parlour at Preston; and it is sufficient to convince any competent judge of such matters, that the

author of the machine was a great master of the principles of mechanical combination, or, to borrow an expression from phrenology, that he was endowed in an eminent degree with the organ of constructiveness.

In December 1775, Mr. Arkwright obtained his second patent, which embraced the whole train of operations in a complete cotton-factory, admirably arranged in subordination to each other, but somewhat enigmatically described, in order, as the inventor afterwards said, to prevent such important discoveries as *he was conscious of promulgating, from being pirated by foreigners.* So few patents were sued for in those days, and the laws relating to them were so little understood by patentees, that a little mystification might be thought perfectly fair and patriotic to secure the invention to one's own countrymen. In this patent Arkwright was accused of having specified, as his own, the contrivances of others; but I conceive the charge has as little foundation as could be found in almost any other specification of complex machinery, were it canvassed with an equally censorious spirit as Arkwright's has been. This patent was for carding, drawing, and roving machines to be used "in preparing silk, cotton, flax, and wool for spinning." Had the inventor been under the guidance of a judicious patent-agent, he would have been able, with his own indisputable new combinations, to have framed a patent perfectly tenable, and exempt from reasonable challenge.

Sir Richard always acknowledged having received cylinder-cards from Northampton, of Paul's construction, where they had been used for carding sheep's wool in a manufactory of stuff hats. But they were very defective, and indeed essentially different from

the cards mounted at Cromford.* As for the drawing machine, a most important element of a spinning factory, it was entirely his own, and is clearly contained in his first patent, being his roller-series without the spindles and flyers. The roving apparatus as first invented by him, was nothing else but a modification of the first patent, in which he used larger drawing-rollers, and substituted for the bobbin a tall revolving tin can or cylinder into which the porous cord of cotton was laid in regular coils by centrifugal force and gravity combined.—*See* vol. ii. p. 59.

The specification of 1775 very properly affirms, therefore, that these new machines were constructed on easy and simple principles, very different from any that had ever yet been contrived.

Patentees are often injured by not defining strictly what they peculiarly claim; and by implicitly following the usual verbiage of specifications. Thus the phrases "first and sole inventor thereof," and that "the same had never been practised by any other person or persons whomsoever, to the best of his knowledge and belief," are regularly repeated in every specification, and must therefore be always liberally and candidly interpreted. Arkwright was unquestionably the first and sole inventor of the complete edifice in its improved state, though certain materials in general use and appropriated to no person in particular might be worked up in it.

One of the most elegant mechanisms in a cotton-factory is that of the crank and comb for stripping the thin fleece of cotton from the doffer cylinder of the carding engine. Several witnesses in the trial to re-

* See Vol. ii. pp. 29, 30.

duce Arkwright's second patent, swore that the above invention belonged to James Hargreaves, the author of the jenny. Even the widow and son of this ingenious man gave evidence to that effect, and the smith who made the crank and comb for Hargreaves confirmed it. Yet Mr. Baines, who had been so strongly biassed against Sir R. Arkwright, as to adopt, in his octavo History of Lancashire, Guest's apocryphal statement of Highs' counter-claims as a true narrative of factory invention, acknowledges that he has recently received decisive testimony in Arkwright's favour as to the crank and comb, from the son of Mr. James, the partner of Hargreaves.

"He (James Hargreaves) was not the inventor of the crank and comb. We had a pattern chalked out upon a table by one of the Lancashire men in the employ of Mr. Arkwright; and I went to a frame-smith of the name of Young, to have one made. Of this Mr. Arkwright was continually complaining, and it occasioned some angry feelings between the parties."*

Here is a confession from James, the very person who was the chief accessory to the piracy of Arkwright. From this specimen we may form a judgment of the rest of the evidence vamped up at the trial against Arkwright. If any one will candidly analyze his original model, he will see how natural it was for him to advance in the straight road of improvement to which the principles of his mechanism spontaneously led.

Arkwright had great reason to be disgusted with his Lancashire compatriots, when he found them flocking to him merely for the purpose of pilfering

* *History of the Cotton Manufacture*, by Edward Baines, jun. Esq., pp. 177, 178.

his plans, and communicating them to his piratical competitors, who, if left to their own resources, would never have made a single hank of good yarn. It was in this way that many of his most valuable contrivances, the fruits of much thought and exertion, were snatched up and spread abroad before he had time to mature them to his mind, and embody them in his second patent—so that he found his own ideas stolen and fraudulently turned against him by his adversaries in a court of justice.

The difficulties which Arkwright encountered in organizing his factory system, were much greater than is commonly imagined. In the first place, he had to train his work-people to a precision in assiduity altogether unknown before, against which their listless and restive habits rose in continual rebellion; in the second place, he had to form a body of accurate mechanics, very different from the rude hands which then satisfied the manufacturer; in the third, he had to seek a market for his yarns; and in the fourth, he had to resist competition in its most odious forms. From the concurrence of these circumstances, we find that so late as the year 1779, ten years after the date of his first patent, his enterprise was regarded by many as a doubtful novelty. One event has been adduced in evidence of the uncertainty of his condition, which ought to excite interest in his behalf. He parted from his wife in 1779, because she would not agree to join him in converting some landed property into money, for the sale of which her consent was required by law. The property was worth, it is said, little more than four hundred pounds. Mrs. Arkwright entertained a high esteem for her husband, and always

spoke of him with respect; yet she preferred separating from him, to the chance of being beggared by placing her dowry in so precarious a concern as she then thought the water-spinning frame to be. For some years after this event she lived altogether upon her own means. Mr. Arkwright was justly indignant at this want of sympathy in one so nearly related to him, and in consequence allowed her only thirty pounds a-year, out of his own pocket, even when he had realized great opulence. These particulars are given by Mr. Guest on the authority of Sir Richard Arkwright's niece, probably a disappointed and prejudiced person.*

The story has upon the whole an apocryphal air. There was certainly no scarcity of funds in 1779, to carry on the existing establishment at Cromford with the utmost vigour. Arkwright was, we own, a man of no common ambition. Perceiving at this period the means of placing money to prodigious advantage in other concerns which he projected, he might be mortified beyond measure at the want of spirit and confidence in his wife, and might have resented it as an insult to his understanding. Nor are we to suppose that his water-frame mechanism, though rude in aspect compared with the modern throstle, did not spin excellent twist. He, his son, and his partners, the Messrs. Strutt, with the machines of that time, turned off, by dint of superior tact and attention, warp and hosiery yarn as fine as 80's, or even 100's, which might bear a comparison with the firmest and most evenly water-twist of the present day. It is the glory of modern mechanics that their machines produce good yarn on automatic principles with hands

* *The British Cotton Manufactures*, by Richard Guest. 8vo. Manchester, 1828.

relatively unskilful, and with very little superintendence. A few old water-frames still exist, both at Cromford and Belper, which spin good hosiery and thread yarns of eighty hanks to the pound.

The malignity displayed against Arkwright by the cotton manufacturers of Lancashire, as soon as they recognised the superior quality of his yarn, and found they could not equal it by jenny-spinning, exceeds anything to be found in the history of commerce. They not only bribed away his best servants, but they fomented the evil passions of the mob into such a paroxysm of rage, as to cause a mill built by Arkwright, at Birkacre, near Chorley, to be burned, in the presence of a powerful body of police and military, without any of the civil authorities requiring their interference to prevent the outrage. But the most extraordinary piece of malevolence, which, if not well attested, would be incredible, was, the manufacturers of Lancashire combining not to buy his yarn, though it was acknowledged to be superior in quality to any in the market.

The following are extracts from the *Case* which Mr. Arkwright published soon after the first trial of his patent in 1781, when it was declared invalid, on the score of obscurity and defectiveness in the specification.

"Mr. Arkwright, after many years' intense and painful application, invented, about the year 1768, his present method of spinning cotton, but upon very different principles from any invention that had gone before it. He was himself a native of Lancashire; but having so recently witnessed the ungenerous treatment of poor Hargreaves, by the people of that country, he retired to Nottingham, and obtained a patent

in the year 1769, for making cotton, flax, and wool into yarn. But after some experience, finding that the common method of preparing the materials for spinning (which is essentially necessary to the perfection of good yarn) was very imperfect, tedious, and expensive, he turned his thoughts towards the construction of engines for that purpose; and in the pursuit spent several years of intense study and labour, and at last produced an invention for carding and preparing the materials, founded in some measure on the principles of his first machine. These inventions united, completed his great original plan. But his last machines being very complicated, and containing some things materially different in their construction, and some others materially different in their use from the inventions for which his first patent was obtained, he procured a patent for these also, in December 1775.

"No sooner were the merits of Mr. Arkwright's inventions fully understood, from the great increase of materials produced in a given time, and the superior quality of the goods manufactured; no sooner was it known that his assiduity and great mechanical abilities were rewarded with success, than the very men who had before treated him with contempt and derision, began to devise means to rob him of his inventions, and profit by his ingenuity. Every attempt that cunning could suggest for this purpose was made, by the seduction of his servants and workmen (whom he had with great labour taught the business). A knowledge of his machinery and inventions was fully gained. From that time many persons began to pilfer something from him; and then by adding something else

of their own, and by calling similar productions and machines by other names, they hope to screen themselves from punishment. So many of these artful and designing individuals had at length infringed on his patent right, that he found it necessary to prosecute several; but it was not without great difficulty, and considerable expense, that he was able to make any proof against them; conscious that their conduct was unjustifiable, their proceedings were conducted with the utmost caution and secrecy. Many of the persons employed by them were sworn to secrecy, and their buildings and workshops were locked up, or otherwise secured. This necessary proceeding of Mr. Arkwright occasioned, as in the case of poor Hargreaves, an association against him of the very persons whom he had served and obliged. Formidable, however, as it was, Mr. Arkwright persevered, trusting that he should obtain, in the event, that satisfaction which he appeared to be justly entitled to.

"A trial in Westminster Hall, in July last, at a large expense, was the consequence; when, solely by not describing so fully and accurately the nature of his last complex machines as was strictly by law required, a verdict was found against him. Had he been at all aware of the consequences of such omission, he certainly would have been more careful and circumspect in his description. It cannot be supposed that he meant a fraud on his country; it is on the contrary most evident that he was anxiously desirous of preserving to his native country the full benefit of his inventions. Yet he cannot but lament that the advantages resulting from his own exertions and abilities alone, should be wrested from him by those who

have no pretensions to merit; that they should be permitted to rob him of his inventions before the expiration of the reasonable period of fourteen years, merely because he has unfortunately omitted to point out all the minutiæ of his complicated machines." "In short, Mr. Arkwright has chosen a subject in manufactures (that of spinning), of all others the most general, the most interesting, and the most difficult. He has, after near twenty years' unparalleled diligence and application, by the force of natural genius, and an unbounded invention (excellences seldom united), brought to perfection machines on principles as new in theory, as they are regular and perfect in practice. He has induced men of property to engage with him to a large amount; from his important inventions united, he has produced better goods of their different kinds than ever were before produced in this country; and finally he has established a business that already employs upwards of 5,000 persons, and a capital, on the whole, of not less than £200,000,—a business of the utmost importance and benefit to this kingdom."

Mr. Arkwright's object at this time was to obtain from the Legislature an Act of Parliament to guarantee to him the patent right of which he had been deprived in a court of law; an object which he did not prosecute any further.

Let us now turn to another just ground of complaint stated in the *Case*.

"It was not till upwards of five years had elapsed after obtaining his first patent, and more than £12,000 had been expended in machinery and buildings, that any profit accrued to himself and partners." "The most excellent yarn and twist was produced; notwith-

standing which the proprietors found great difficulty to introduce it into public use. A very heavy and valuable stock, in consequence of these difficulties, lay upon their hands; inconveniences and disadvantages of no small consideration followed. Whatever were the motives which induced the rejection of it, they were thereby necessarily driven to attempt, by their own strength and ability, the manufacture of the yarn.* Their first trial was in weaving it into stockings, which succeeded; and they soon established the manufacture of calicoes, which promises to be one of the first manufactures in the kingdom. Another still more formidable difficulty arose; the orders for goods which they had received being considerable, were unexpectedly countermanded, the officers of excise refusing to let them pass at the usual duty of 3*d*. per yard, insisting upon the additional duty of 3*d*. per yard, as being (Indian) calicoes, though manufactured in England; besides these calicoes, when printed, were prohibited. By this unforeseen obstruction, a very considerable and very valuable stock of calicoes accumulated. An application to the commissioners of excise was attended with no success; the proprietors therefore had no resource but to ask relief of the Legislature, which, after much money expended, and against a strong opposition of the manufacturers in Lancashire, they obtained."†

Of this opposition it may be said, the force of envy and hatred could carry tradesmen no further than for the purpose of harassing a prosperous rival, to keep themselves and their trade in a most galling

* To work it up into cotton cloths and hosiery.
† *Case in Arkwright's Patent Trial*, p. 99.

and ruinous bondage under bad laws. Mr. Baines reprobates this malignant spirit with just severity: "The prohibition of English-made calicoes was so utterly without an object, that its being prayed for by the cotton manufacturers of this country is one of the most signal instances on record of the blinding effects of commercial jealousy. The Legislature did not yield to the despicable opposition offered to the reasonable demand of Mr. Arkwright and his partners (Messrs. Need and Strutt), but on the contrary, passed a law in 1774, sanctioning the new manufacture, and rendering English calicoes subject to a duty of only 3*d.* per square yard on being printed."*

We may now form some estimate of the formidable obstacles with which the Genius of factory industry had to contend during the greater part of his illustrious career, and of his transcendent merit in triumphing over them all. Nothing certainly could be more vexatious than to find the greatest channel to national wealth ever laid open by inventive enterprise, forthwith dammed up by the folly of fiscal legislation. Though zealous patriots had for more than a century been exclaiming against the ascendency of Indian cotton goods over our home-made linens and woollen stuffs, yet at length, when the means of rivalling them in quality and of outstripping them in cheapness are found, they cannot be exercised! and the inventors are to be ruined unless they possess sufficient wealth and influence to get the preposterous laws repealed!

Parliament was pleased in 1774 to recognize the propriety of permitting genuine cotton fabrics to be made, without intermixture of linen warp, and thus

* *History of the Cotton Manufacture*, p. 167.

removed one of the numerous shackles which their wise predecessors had placed upon industry. In tracing the history of the British cotton trade, a brief outline of this *Act for ascertaining the duty on printed, painted, stained, or dyed stuffs wholly made of cotton, and manufactured in Great Britain; and for allowing the use and wear thereof, under certain regulations*, deserves a place. Its preamble states, that "Whereas a new manufacture of stuffs, wholly made of raw cotton wool (chiefly imported from the British plantations), hath been lately set up within this kingdom, in which manufacture many hundreds of poor persons are employed; and whereas the use and wear of printed, &c., stuffs wholly made of cotton and manufactured in Great Britain, *ought to be allowed under proper regulations*; and whereas doubts have arisen whether the said new manufactured stuffs ought to be considered as calicoes, and as such, if printed, &c., liable to the inland or excise duties laid on calicoes when printed by the existing statutes, whether the use or wearing of the said new manufactured stuffs, when the same are printed, &c., are not prohibited by an Act passed 7 Geo. II., intituled, An Act to preserve and encourage the woollen and silk manufactures of this kingdom, and for more effectually employing the poor by prohibiting the use and wear of all printed, &c., calicoes in apparel, household stuff, furniture, or otherwise, after the 25th of December, 1722. For obviating all such doubts for the future, be it enacted, that no greater or higher duty than three-pence for every yard in length, reckoning yard wide, shall be imposed on the said manufactured stuffs wholly made of cotton spun in Great Britain when printed.

"And be it further enacted, that it shall be lawful for any person to wear any new manufactured stuffs wholly made of cotton when printed.

"And be it further enacted, that in each piece of the said calicoes, there shall be wove in the warp in both selvages through the whole length thereof three blue stripes, each stripe of one thread only; and that each piece when printed be stamped at each end by an excise officer with the words *British Manufactory.*'

Persons who sold such stuffs without the stamp were liable to a fine of £50 for each piece, besides its forfeiture; those who imported them were liable to £10 on each piece, besides the forfeiture; and whoever counterfeited the stamp, or sold goods so counterfeited, was punishable by death. This Act, which did not extend to cotton velvets, velverets, and fustians, is of itself a complete demonstration of Arkwright's peculiar merit, for it was framed solely to suit the new style of goods of which his water-twist warp was the characteristic constituent. Nobody can pretend that at this period, and for several years thereafter, any factory except those erected and superintended by Arkwright produced cotton yarn fit to form the warp of a good printing calico.

The field of enterprise in cotton spinning being now left free by the Legislature, Arkwright, who had been since 1771 organizing the several members of his factory system at Cromford, in co-operation with Mr. Strutt, brought forth, as we have said, the patent specification of it in 1775, but its constituent parts had been undergoing for the three preceding years daily experimental probation, exposed to invidious *espionage* and petty piracy, as exemplified in the crank and comb.

"Most of these improvements (relative to the carding engine) are to be ascribed to Arkwright, and he showed his usual talent and judgment in combination, by putting all the improvements together, and producing a complete machine, so admirably calculated for the purpose that it has not been improved upon till the present day."* I entirely concur in this sentiment. On the subject of the cards, which constitute the main novelty in Arkwright's patent of 1775 (for the drawing and roving principles are clearly developed in the first patent), the claims of Highs will appear not only futile but ludicrous to any one who will candidly consider the silly answers which he made upon the trial in 1785.

" *Q*. Have you actually ever made, or not, any of these carding engines?—*A*. I have made carding machines, but not with these individual things as this is; there are various forms.

Q. What did you do with them; did you sell any of them?—*A*. Yes, Sir, I sold them.

Q. How many did you?—*A*. I suppose four or five, but then I never made but one in this method; I tell nothing but the truth.

Q. You never made but one of that kind?—*A*. No, I did not.

Q. It did not answer?—*A*. It did not answer the end the gentleman wanted it for; *you know it is nothing to me. I had nothing to do but to work as I was ordered.*"†

* *History of the Cotton Manufacture*, by Edward Baines, jun. Esq. p. 179.

† *A Compendious History of the Cotton Manufacture*, by Richard Guest, p. 59.

How unlike are these statements to those of a practical man who had constructed a really operative machine? He makes only one card, even that not from his own invention, but as he was ordered—and, after all, it did not answer. Such were Highs' exploits in 1772 or 1773, when Mr. Arkwright was bringing beautiful hosiery twist into the market, in the preparation of which his improved cards, with a perpetual fleece taken off by the crank and comb, were employed. This continuity of the fleece also proves the priority of his claim in the feed-cloth to Wood and Pilkington, for though they used the same thing before the patent of 1775 was obtained, they might most easily have procured the plan from some of his stray workmen, or have obtained hints of what had been done at Cromford in 1772, and thus have stolen a march upon him. The claim made by them goes no further back than the year 1774. Mr. James, the living witness to the fact of the crank and comb being Arkwright's invention, before 1772, is worthy of all credit, since, according to Mr. Baines, at 83 years of age, he still enjoys a most retentive memory.* We may therefore receive, without any hesitation, the statement given in the *Case* that they were his own series of inventions which Arkwright "sold to numbers of adventurers residing in the different counties of Derby, Leicester, Nottingham, Worcester, Stafford, York, Hertford, and Lancaster; and that, upon a moderate computation, the money expended in consequence of

* Mr. Guest says, at p. 19 of his *Compendious History*, that Hargreaves invented the crank and comb in 1772; but as Mr. James declares that his partner Hargreaves pirated the invention from Arkwright, its invention, by the latter, must have been of an earlier date.

such grants (or patent licences) before 1782, amounted to at least £60,000. He and his partners also expended, in large buildings in Derbyshire and elsewhere, upwards of £30,000, and he himself erected a very large and extensive building in Manchester, at the expense of upwards of £4,000, forming altogether a business which already employed upwards of 5,000 persons, and a capital on the whole of less than £200,000."

Mr. Kennedy, in his instructive memoir on the Rise and Progress of the Cotton Trade, makes the following observations:—"During a period of ten or fifteen years after Mr. Arkwright's first mill was built (in 1771) at Cromford, all the principal works were erected on the falls of considerable rivers; no other power than water having then been found practically useful; there were a few exceptions, where Savary's and Newcomen's steam-engines were tried. But the principles of these machines being defective, and their construction bad, the expense in fuel was great, and the loss occasioned by frequent stoppages was ruinous."*

We cannot better conclude this investigation into the origin of the factory system than by the following judicious remarks of Mr. Bannatyne, author of the interesting article Cotton, in the *Encyclopædia Britannica*. "The originality and comprehensiveness of Sir Richard Arkwright's mind was perhaps marked by nothing more strongly than the judgment with which, although new to business, he conducted the great concerns his discoveries gave rise to, and the systematic order and arrangement which he introduced into every

* *Memoirs of the Manchester Literary and Philosophical Society*, vol. iii., 2d series.

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department of his extensive works. His plans of management, which must have been entirely his own, as no establishment of a similar nature then existed, were universally adopted by others, and, after long experience, they have not yet in any material point been altered or improved."

In another work* I have said, " It required a man of a Napoleon nerve and ambition to subdue the refractory tempers of workpeople accustomed to irregular paroxysms of diligence, and to urge on his multifarious and intricate constructions in the face of prejudice, passion, and envy. Such was Arkwright, who, suffering nothing to stay or turn aside his progress, arrived gloriously at the goal, and has for ever affixed his name to a great era in the annals of mankind,—an era which has laid open unbounded prospects of wealth and comfort to the industrious, however much they may have been occasionally clouded by ignorance and folly. Prior to this period manufactures were everywhere feeble and fluctuating in their development, shooting forth luxuriantly for a season, and again withering almost to the roots, like annual plants.'

That Arkwright derived useful hints and aids from many quarters in his wonderful career, is undeniable, and that he most skilfully adapted the scattered fragments of ingenuity to his grand factory system, redounds much to his honour. He was, however, the original architect, as well as the master-builder of his new edifice. Like Columbus he meditated many years on the erratic excursions of his predecessors in the narrow seas of industry, and having convinced himself that a new world replete with wealth might

* *Philosophy of Manufactures*, p. 16.

be reached by a bolder navigation, he fearlessly embarked his life and fortunes in quest of it, with means little commensurate to the dangers, difficulties, and magnificence of the enterprise. Fortunately for the Englishman, he did not depend on the patronage of princes and courts, but with the co-operation of two or three spirited fellow-citizens he advanced with unfaltering energy towards his object, living in affluence, and dying in honour. The Genoese, after wasting many painful years as a needy supplicant to kings, obtained but a paltry equipment for his heroic expedition, and was rewarded at last by disgrace, poverty, and a prison. Richard Arkwright, on the other hand, within eighteen years of constructing his first model, had risen to such estimation in the great county of Derby, that he was elected to the dignity of High Sheriff, and soon thereafter received the honour of knighthood from King George III., no indifferent judge of mechanical merit. Although athletic in form and power, his corporeal frame never possessed firm health; during the greater part of his factory exertions he laboured under asthmatic ailments, and in the year 1792, the sixtieth of his life, he sunk under a complication of maladies.

The powerful men who have been raised up by Providence from time to time, to move the stagnant waters of civilization, such as Luther, Calvin, and Knox, have been regarded by their torpid compatriots as coarse and turbulent spirits, because they reprobated the unprofitable, frivolous, and corrupt practices prevalent in their day. In like manner the intrepid reformer of industry, Arkwright, has been accused of roughness, because, impatient of the slovenly habits of

workpeople, he urged on their labours with a precision and vigilance unknown before. But a gentler or more timid master would have been unequal to the task he took in hand; hence, even his failings on this account may be said to have leaned to virtue's side, and to have been of incalculable service to his country, and to mankind.

His career in manufactures may be compared not unappropriately to that of Newton in science. The English philosopher has never been reproached for making use of the prior researches of Copernicus, Kepler, and Galileo, but has obtained immortal renown by uniting and perfecting them into one great system of doctrine. His precursors had conceived that in all the bodies of the universe there exists a reciprocal attractive force; but their attempts to ascertain the law of the decrease of this force, by distance, were unavailing, from the defect of their powers of generalization. Descartes first conceived the bold idea of referring to a single cause the phenomena of both the heavens and the earth; but Newton had the honour of demonstrating its nature and effects. Attraction proportional directly to the mass, and inversely to the square of the distance, became in his hands the main spring of the universe. A body may be weighed at the surface of the earth, but were it transported to the surface of Jupiter, Saturn, or the Sun, what weight would it have then? Before the end of the 17th century this problem would have been regarded as incapable of solution, and its proposer would have passed for a fool.

It excited, therefore, no small astonishment when Newton solved it in a satisfactory manner. He discovered the proportion between the masses of the Sun,

Jupiter, and the Earth by combining the above law of attraction with one of Kepler's laws; and as the proportion which exists between the diameters of the orbit of Jupiter and the Earth was approximately known before his time, he found, by division, the ratios of the weights of the same body placed successively on the surfaces of these spheres. Descartes ascribed to the pressure of the moon the periodical oscillations daily displayed by the waters of the ocean, and Galileo referred them to the rotation of the earth, combined with its movement in the ecliptic; but these vague and random explanations were incapable of lifting up the veil which covered the phenomenon. Newton studied its causes with the aid of geometry, and showed how all the attendant circumstances proceeded spontaneously from his great principle of gravitation. When the moon passes the meridian the particles of the sea nearer this luminary than the centre of our globe, are more powerfully attracted than that centre, and hence rise and recede from the earth in obedience to that excess of attractive force exercised by the moon. The particles of the sea, situated in the corresponding point of the opposite hemisphere being less powerfully attracted by the moon than the centre of the earth, on account of their greater distance, will be attracted more feebly towards that luminary than the centre of the earth. Thus the particles of the ocean will rise from the earth at the two extremities of its diameter in the direction of the moon, constituting high water or the flux. Invidious cavillers might easily find, in writers before Newton's time, hints of both planetary attraction and of the lunar influence on the tides, but they would be laughed to scorn by

all judicious critics. In like manner automatic spinning by cards and rollers was attempted prior to Arkwright, but in a random, ill-digested, and unsystematic manner.

In the neighbourhood of Preston, during the juvenile years of Arkwright, there was a considerable manufacture of linen and cotton goods mixed, with the operations of which he had an opportunity of becoming intimately acquainted; and being a man of uncommon natural powers, he directed his thoughts to the improvement of the mode of spinning. The first hint respecting the means of effecting this improvement, he said, he accidentally received from seeing a red-hot iron bar elongated by being passed through iron rollers.* Between this operation and that of elongating a thread as now practised in spinning, there is no mechanical analogy; yet the hint being pursued, has produced an invention, which, in its consequences, has been a source of individual and national wealth, unparalleled in the annals of the world.

The difficulties which Mr. Arkwright experienced before he could bring his machine into use, even after its construction was sufficiently perfect to demonstrate its value, would, perhaps, have for ever retarded its competition, if his genius and application had been less ardent. His circumstances were by far too unfavourable to enable him to commence business upon his own account, and few were willing to risk the loss of capital in an untried establishment.

Soon after the erection of the mill at Cromford, he

* Samuel Crompton ascribed his first idea of roller-spinning to the same observation; and it is probable that Wyatt got his suggestion in the same way.

made many improvements in the mode of preparing the cotton for spinning, and invented a variety of ingenious machines for effecting this purpose in the most correct and expeditious manner; for all of which he obtained a patent in the year 1775; and thus completed a series of machinery so various and so complicated, yet so admirably combined, and well adapted to produce the intended effect, in its most perfect form, as to excite the admiration of every person capable of appreciating the difficulties of the undertaking.

That all this should have been accomplished by the single efforts of a man without education, without mechanical knowledge, or even mechanical experience, is most extraordinary; and is, perhaps, equal to any example existing, of the wonderful powers exhibited by the mind, when its efforts have been steadily directed to one object. Yet this was not the only employment of this eminent man. He was introducing into every department of the manufacture a system of industry, economy, order, and cleanliness, till then unknown in any great establishments where many people were employed together; but which he so effectually accomplished, that his example may be regarded as the pattern of almost all subsequent improvements. When it is considered, that during this entire period, he was afflicted with a grievous disorder (a violent asthma), which was always extremely oppressive, and sometimes threatened immediately to terminate his existence, his unceasing industry must excite astonishment. In speaking of his inventions, Arkwright expressed ideas of their importance, which to persons less acquainted with their merits appeared hyperbolical. They are all now more than realized.

Several years before his death, Sir Richard Arkwright gave up to the present Richard Arkwright, Esq., of Willersly Castle, his mill at Bakewell. Here the son displayed talents worthy at once of the father from whom he had sprung, and of the manufacturing establishment of Cromford, where he had been trained. I was informed by an indisputable authority,* that Mr. Arkwright then spun water-twist yarns of as high a count as 80s. of excellent quality, whereby he realized by his skill and assiduity in that factory alone no less than £20,000 per annum. This circumstance proves, beyond all controversy, the perfection to which cotton machinery had been brought by the hands of this distinguished family.

In the year 1754 Mr. Jedediah Strutt, then a farmer, being informed by his wife's brother, who was a hosier, and well acquainted with the stocking frame, of some unsuccessful attempts that had been made to manufacture ribbed stockings upon it, was induced to investigate the operations of that curious and complicated machine, in the hope of effecting what others had attempted in vain. Accordingly, after much time, labour, and expense, having succeeded, he obtained, in conjunction with his brother-in-law, a patent for the invention, and removed to Derby, where he established an extensive manufacture of ribbed stockings, which was successfully carried on by himself and partners for more than half a century. About the year 1771 Mr. Strutt entered into partnership with Sir R. Arkwright. In 1775 he began to erect the cotton works at Belper

* This circumstance was told me by George Benfield Strutt, Esq., of Bridge Hill, Belper, during my visit to his hospitable mansion, in August 1834.

and Millford, at each of which places he resided a considerable time; but as his health declined he retired to Derby, where he died in 1797, in the seventy-first year of his age. His three sons had conducted his great cotton spinning concerns for many years before his death with progressive enterprise and intelligence.

William, the eldest, had the honour of co-operating with Sir Richard Arkwright at the very commencement of his great factory career, and being a well educated and highly gifted mechanician, was able to appreciate the character of that extraordinary man. Had Arkwright's schemes been mere plagiarisms of other men's ideas, as some of his modern defamers would have us believe, they could not have escaped the discernment, but would infallibly have revolted the candid spirit, of Mr. Strutt. Yet no man estimated more highly than he did the inventive genius and excellent judgment of Sir Richard Arkwright, of which he afforded the best evidence in the account of the Cromford cotton works, which was drawn up by him for Mr. Brayley, and inserted in vol. iii. of this learned gentleman's *Beauties of England and Wales*—under the article 'Derbyshire.'

"The establishment of the mill at Cromford village," says Mr. Strutt, "proved a source of much legal contention; for the manufacturers of Lancashire, apprehensive of what has actually been the result, that it would supersede the use of the hand machines then employed, formed a strong combination to impede its success, and endeavoured to destroy the validity of the patent, by contesting the originality of the invention; and though in two instances they obtained a favourable verdict,

from particular circumstances, and lost it in a third, there cannot be a doubt that *every really essential* part of the machinery derived its structure from the powerful genius of Mr. Arkwright. A great quantity of the cotton spun by this machinery is used by hosiers, who find it more suitable to their purpose than any other they can procure."

Mr. Brayley has kindly put into my hands the original manuscript of the above narrative, in Mr. Strutt's handwriting.

We have already described the dangers which the factory system experienced in its infancy from ruffian violence. The year 1779 was remarkable for a general assault upon spinning machinery in several counties of England. Though there was no scarcity of employment at good wages, and though much pains had been taken to convince the populace that their condition would be improved by the increased facilities of manufacture,* yet a notion was artfully instilled into their minds, that the new machines would ere long entirely supersede manual labour. Under the influence of such illusions, a third and more formidable set of mobs assembled in Lancashire, which destroyed all the carding and spinning machinery moved by

* Particularly by Dorning Rasbotham, Esq., an enlightened magistrate near Bolton, who circulated a printed address among the weavers and hand spinners, explaining to them that every contrivance for cheapening production would increase the demand for their goods, and, consequently, the employment of their labourers. The upper orders also fermented these anti-factory outrages, from an apprehension that the multiplication of machinery would throw a number of idle hands upon the parish funds. When Arkwright made his working model at Warrington, probably not more than 30,000 persons were occupied with the manufacture of cotton; now there are many more than a million, and at equal average wages.

water or horses, as also the hand jennies containing more than twenty spindles; the maximum prescribed by the demagogues. This riot was most active in the neighbourhood of Blackburn, then the focus of the cotton industry of the county. Jennies mounted with twenty spindles and under being reckoned laudable inventions were respected; but those of greater size were either cut down, Procrustes wise, to the standard, or if refractory to the amputation, they were consigned to the flames. Mr. Peel, afterwards Sir Robert, the father of our illustrious statesman, had his machinery at Altham totally demolished, the fragments thrown into the river, and his person placed in imminent danger from a licentious mob. He consequently withdrew in disgust from the county, transferring the benefits of his capital, skill, and public spirit to Burton, in Staffordshire, on the banks of the Trent, where he established a cotton factory, and where he continued to reside for many years. Thus the populace, by violence, drew down conspicuous retribution on themselves; nor was it till a more gentle spirit prevailed that Mr. Peel, and other refugee capitalists, ventured to resume their enterprises among them.

The water-twist frame, as used by Sir R. Arkwright, at Cromford, and the Messrs. Strutt's at Belper, is represented in figure 19.

A is a bevel wheel fixed upon a horizontal axis, which extends through the whole length of the mill. This wheel turns a smaller one upon a vertical axis, B, which has a drum, C, at the lower end. Round this drum the strap, *a*, runs, which actuates directly all the spindles, and indirectly the whole machine. Another strap, *b*, runs to the right hand, to work another frame, not shown here. The axis B passes down through

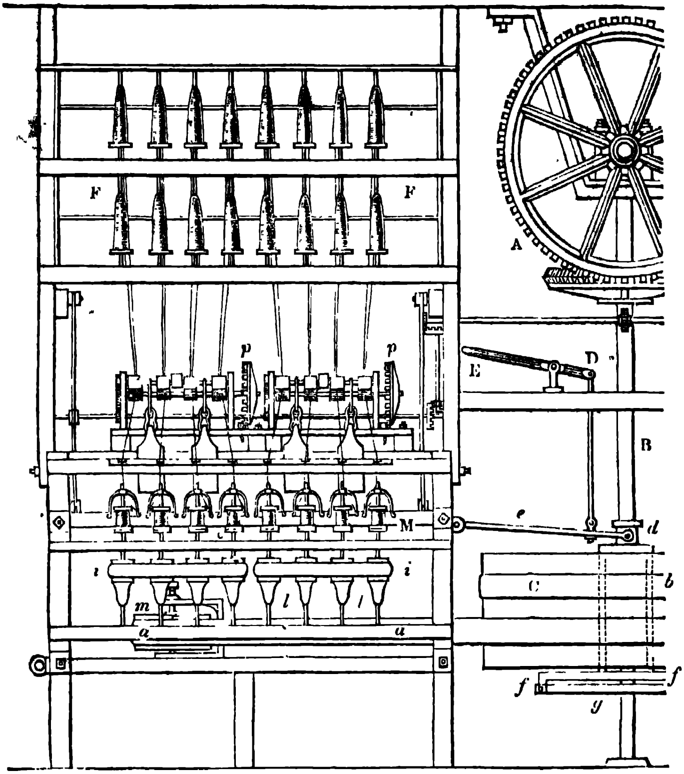

Fig. 19.—Water-Twist Frame, as used at Cromford and Belper.

the drum C, with a circular fitting, so that it slips freely round within it, without giving motion to the drum, till it be put in gear by two locking bolts, which are fixed into a socket piece, *d*, made to slide up and down the axis. It has a groove formed round it, in which a fork at the end of a lever, *e*, is received, so that the fork embraces the piece, *d*, in the groove, and when lifted, raises the two locking bolts with it. This lever is raised by the power of a second lever, D, E,

whose extremity, E, being depressed, raises the lever, *e*, and unlocks the drum from its vertical shaft, B, by withdrawing the locking bolts from their contact with an arm, *f*, of a wheel, *g*, fixed to the shaft below the drum, so as to turn with it; the locking bolts being let down, that their ends may project through the drum, and intercept the cross arm, *f*, of the wheel, the drum and all the machinery are set in motion.

The endless strap *a*, *a* passes the whole length of the frame, makes a turn round the pulley *m*, and comes back again. The pulley *m* is fitted in a frame, and by means of a screw can be strained to make the strap tight.

The bobbins of rovings are set loose on skewers in the creel of two shelves at F. The rovings pass then down to the drawing-rollers, which are turned by the contrate wheels *p*, *p*. The attenuated threads delivered by the front rollers are twisted by the rotation of the spindles and flyers, and wound by friction round the bobbins, which are made to traverse up and down for the distribution of the spun yarn upon their barrels, by the rise and fall of the copping-rail M. *i*, *i* shows a band or belt passing over the whorls of the spindles to drive them. Under *l*, *l* the lower conical ends of the spindles are seen supported in steps, lubricated with oil.

Arkwright's system of machinery was most advantageously applied to spin warp and hosiery yarns, of a hard and compact fabric, of any grist up to seventy or even eighty hanks in the pound; Hargreaves' to spin soft weft-yarn of somewhat inferior numbers, which answered well for filling the surface of calico cloth; and on these two independent plans the whole cotton

yarn used in the kingdom was spun for a good many years. The jenny was, however, eventually superseded by a very beautiful apparatus, invented by Samuel Crompton, of Bolton, to which, as being the offspring the above two distinct machines, and as combining their respective features, the name of Mule, or Mule Jenny, was fancifully, but not inappropriately given. This curious complex combination was contrived by its humble author about the year 1776, but it was not so perfected and made public as to come into general use till about the year 1786. Indeed, had not Sir Richard Arkwright's patent of 1775 been abrogated, the mule, as embodying his system of drawing-rollers, must have remained in abeyance upon his monopoly. In the place of Arkwright's bobbins and flyers, Mr. Crompton used the spindle carriage of Hargreaves' jenny to receive, attenuate, twist, and wind on the threads, after their emergence from the drawing-rollers. The particular description of this admirable machine belongs, however, to a subsequent chapter of this work. The mule enabled the spinner to make a prodigious advance in the fineness as well as rapidity of his work; and it may be considered as the parent of the muslin manufacture, destined in a short time to render Europe the successful competitor of the hitherto unrivalled productions of Hindostan.

John Kennedy, Esq., one of the most scientific manufacturers of the kingdom, fortunately for Mr. Crompton's fame, has favoured the world with an account of his life and labours; a memoir which does equal honour to its author's head and heart. This interesting paper was read before the Literary and Philosophical Society of Manchester, February 20, 1830.

Samuel Crompton was born on the 3d December, 1753, at Firwood, in Lancashire, where his father held a farm of small extent; and, according to the custom of those days, employed a portion of his time in carding, spinning, and weaving. Hall-in-the-wood, a picturesque cottage near Bolton, became the residence of the family during the son's infancy, and the memorable scene of his juvenile inventions. His father died when he was very young. The care of his education devolved on his mother, a pious woman, who lived in a retired manner, and imparted her own sincere and contemplative turn of mind to her son. In all his dealings through life Samuel was strictly honest, patient, and humane.

When about sixteen years old, namely, about 1769, he learned to spin upon a jenny of Hargreaves' make, and occasionally wove what he had spun. Being dissatisfied with the quality of his yarn, he began to consider how it might be improved, and was thus naturally led to the construction of his novel spinning machine. He commenced this task when twenty-one years of age, and devoted five years to its execution. As he was not, properly speaking, a mechanic, and possessed only such simple tools as his little earnings at the jenny and the loom enabled him to procure, he proceeded but slowly with the construction of his mule, but still in a progressive manner highly creditable to his dexterity and perseverance.

He often said that what annoyed him most was that he was not allowed to employ his little invention by himself in his garret; for, as he got a better price for his yarns than his neighbours did, he was naturally supposed to have mounted some superior me-

chanism, and hence became an object of the prying curiosity of the country people for miles around; many of whom climbed up at the windows to see him at his work. He erected a screen in order to obstruct their view; but he continued to be so incommoded by crowds of visiters, that he resolved at last to get rid of the vexatious mystery by disclosing the whole contrivances before a number of gentlemen and others, who chose to subscribe a guinea a-piece for the inspection. In this way he collected about £50, and was hence enabled to construct another similar machine, upon a better and larger plan. The first contained no more than from thirty to forty spindles.

About the year 1802 Mr. Kennedy and Mr. Lee, of Manchester, set on foot a subscription for him, whereby they obtained £500; which formed a little capital for the increase of his small manufactory at Bolton. As a weaver, also, he displayed great ingenuity, and erected several looms for the fancy-work of that town. Being fond of music, he built himself an organ, with which he entertained his leisure hours in his cottage. Though his means were slender, he was such a master of domestic economy, as to be always in easy circumstances. In 1812 he made a survey of all the cotton districts in England, Scotland, and Ireland, and obtained an estimate of the number of spindles at work upon his mule principle—then amounting to between four and five millions, and in 1829 to about seven. On his return, he laid the result of his inquiries before his generous friends Messrs. Kennedy and Lee, with a suggestion that Parliament might possibly grant him some recompense for the national advantages derived from his invention. A memorial was accordingly

drawn up, in the furtherance of which the late George Duckworth, Esq., of Manchester, and the principal manufacturers in the kingdom, to whom his merits were made known, took a lively interest. He went to London himself with the memorial, and had the satisfaction to see a bill pass through parliament for a grant to him of £5000, without deduction for fees or charges.

This sum was advanced to his sons in order to carry on a bleaching concern, for the support of the family. But they mismanaged the business, lost the money, and became bankrupt, reducing their father and sister to poverty. Mr. Kennedy, with Messrs. Hicks and Rothwell, the eminent civil engineers of Bolton, and a few other gentlemen, raised, by a second subscription, a sum which purchased for Mr. Crompton a life annuity of £63. He enjoyed this benevolent pittance only two years, for he died on the 26th of January, 1827, leaving his daughter without any provision.

It would appear that the inventor of the mule had constructed, without having seen Arkwright's drawing rollers, the same kind of roller-beam as exists in his water-twist frame. "Indeed," says Mr. Kennedy, "we may infer that he had not, otherwise he would not have gone thus rudely to work; and indeed the small quantity of metal which he employed, proves that he could not have been acquainted with Mr. Arkwright's superior rollers and fixtures in iron, and their connexion by clock-work. Even the rollers were made of wood, and covered with a piece of sheep-skin, having an axis of iron with a little square end, on which the pulleys were fixed. Mr. Crompton's rollers were supported upon wooden cheeks or stands. He finally put dents of brass-reed

wire into his under rollers, and thus obtained a fluted roller. But the great and important invention of Crompton was his spindle carriage, and the principle of the thread having no strain upon it, until it was completed. The carriage with the spindles could, by the movement of the hand and knee, recede just as the rollers delivered out the elongated thread in a soft state, so that it would allow of a considerable stretch before the thread had to encounter the stress of winding on the spindle. This was the corner-stone of the merits of his invention."

A few machines only were made exactly on Crompton's plan. The first deviation was that of an ingenious mechanic, Henry Stones, of Storwich, near Bolton, who introduced Arkwright's metallic rollers, with clockwork, and a chain to convey motion to the rollers from the fly-wheel, as also some self-acting contrivance to stop the rollers from giving out more attenuated roving than was desired. Hargreaves' spinning-jenny had spread through a circuit of forty miles in extent, round Manchester, including Blackburn, Oldham, Ashton, and Stockport, so as to supersede the single spindle wheel of these districts; but after Crompton's mule became known, the jenny was rapidly laid aside. Up to the year 1783, there were not, in Mr. Kennedy's opinion, one thousand spindles in existence upon Crompton's construction. Soon after the opening up of Arkwright's patent, the preparation machines included in it became available to the trade, and gave mule spinning an extraordinary development.

Among the co-operative aids of this time was the billy, a combination of the jenny and the mule, con-

trived by a person at Stockport, to whom the jenny spinners gave a premium for his ingenuity.

Fig. 20 is a perspective view of the slubbing-billy in common use. A, A is the wooden frame, within which is the moveable carriage, D, D, which runs upon the lower side rails at *a, a*, on friction wheels, 1, 2, to make it glide more easily backwards and forwards from one end of the frame to the other. The carriage contains a number of steel spindles, marked 3, 3, which receive a rapid rotation from a long cylinder, F, by means of separate cords passing round the pulley or whorl of each spindle; the cylinder F is a long drum of tin plate, which extends across the whole breadth of the carriage. The spindles are placed in a frame, so as to stand nearly upright, at about four inches apart; their lower ends are pointed conically, they turn in brass sockets, called steps, and are retained in their position by a smaller collar of brass for each, which embraces the spindle about the middle of its length; the upper half of each spindle projects above the frame. The drum lies horizontally before the spindles, with its centre a little lower than the line of the whorls; the drum receives motion by a pulley at one end, with an endless band from a wheel E, made like the large domestic wheel formerly used in spinning wool by hand, and of similar dimensions. The wheel is placed on the outside of the main frame of the machine, having its axle supported by upright standards, erected from the carriage D; and it is turned by the spinner placed at Q, with his right hand applied to a winch (as plainly shown in the drawing). This gives motion to the drum, and thereby causes the spindles to revolve with great velocity.

Each spindle receives a soft slab or slubbing, which comes through beneath a wooden roller, C, C, at one end of the frame; this is the so much talked of *billy-roller*; the slabs thence proceed to the row of spindles standing in the carriage, so that they are extended in a nearly horizontal plane, advancing to, and receding from, the roller C, so as to extend any required length of slubbing in any degree.

The cardings of wool which are to be spun into slubbings are laid straight, side by side, upon an endless cloth, which is strained in a slanting position between two horizontal rollers, of which one, B, is shown in the figure. One card-end is allotted to each spindle, and the number of spindles may vary from fifty to one hundred in one machine. The roller C rests on the card-ends, which move with the cloth, and as it should press very gently, it is made of light wood; immediately in front of this roller there is a horizontal wooden rail, G, or long bar, with another beneath it, fitted to each other, across the frame. The card-end is conducted between these two rails, the upper or movable one being raised to let it through; when this bar is again let down it pinches the card-end fast, and hence this cloven mechanism is called the clasp; it is precisely what was originally used by Hargreaves in his cotton-jenny.

The upper or moveable rail G is guided between sliders, and a wire, 7, descends from it to a lever, 6. When the carriage D is wheeled close home to the end of the machine, a wheel, 5, lifts up the end 6 of the lever, and this, by the wire 7, raises the upper rail G, so as to open the clasp and release all the card-ends. In this state of things if the carriage be drawn back from the clasp-bar, it will necessarily pull the card-ends

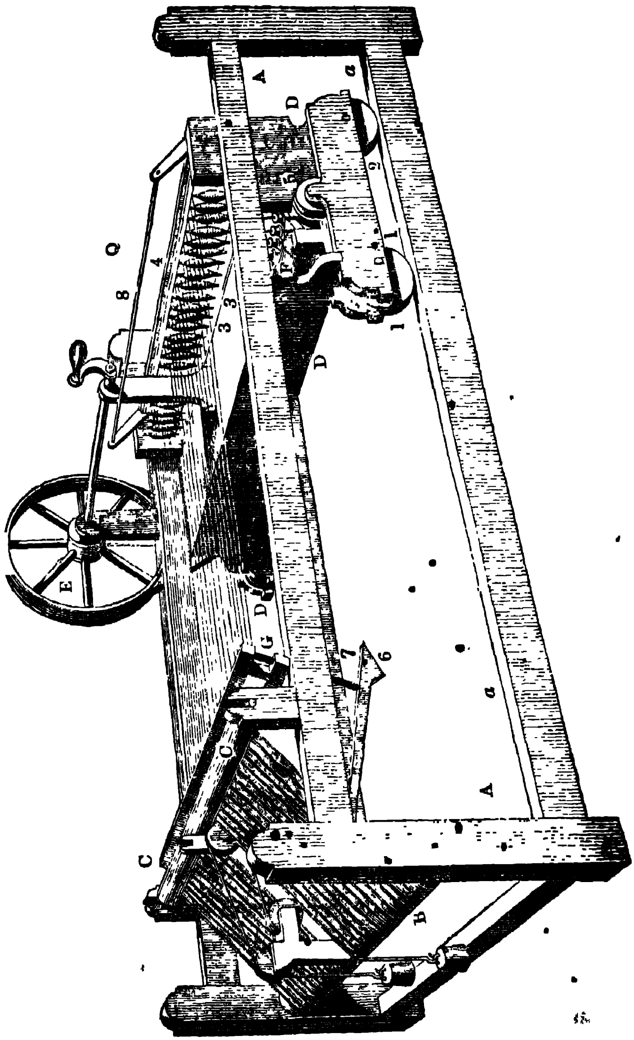

Fig 20.—Slubbing Billy.

forward on their inclined plane. There is a small catch which receives the upper bar, G, of the clasp, and keeps it from falling till the carriage has receded to a certain distance, and has drawn out about eight inches in length of the card-ends; a stop on the carriage then comes against the catch and withdraws it, so as to allow the upper rail to fall and pinch the card-end, while the carriage continues to recede, drawing out or stretching that portion of the roll which is between the clasp and the spindle. Meanwhile the wheel has been turned to keep the spindles in motion, and to give the proper twist to the card-ends in proportion as they are extended, in order to prevent them from breaking.

It might be supposed that the slubbing threads would be apt to coil round the spindles, but as they proceed in a somewhat slanting direction from the clasp, they merely receive a twisting motion, always slipping over the points of the spindles without being wound upon them. Whenever the slubber has given a due degree *of twist to the rovings, he prepares to wind them upon* the spindles in a conical shape, by pressing down with his left hand the faller-wire 8, so as to bear them away from the points of the spindles and place them opposite to their middle part. He now causes the spindles to revolve slowly, and at the same time pushes in the carriage, so as to wind the slubbing upon the spindles into a conical cop.

The wire 8 is made to regulate the winding-on of this whole row of slubbings at once, and is placed at the proper depression for this purpose, by its connexion with the horizontal rail 4, which turns on pivots at its ends in brasses fixed on the standards, which rise from

the carriage D; by turning this rail on its pivots the wire 8 is raised or lowered to any desired degree; the slubber, seizing the rail 4 with his left hand, thereby draws the carriage out, but, on its return, he depresses the faller-wire at the same time that he pushes the carriage before him.

As the card-ends are exceedingly tender, they would readily draw out or break by friction if dragged up the inclined plane. To save the necessity of this traction, a cord is applied round a groove in the middle part of the upper roller, and, after passing over proper pulleys, as shown in the figure, it has a weight suspended at the one end, and another, but smaller, at the other; the small weight serves merely to keep the rope stretched, but the large weight tends to turn the rollers with their endless cloth or apron round in such a direction as to bring forward the card-ends without putting any strain upon them. Every time that the carriage is pushed home, the large weight gets wound up by a piece of wood projecting from the carriage, and *seizing a knot in the cord at the part which lies horizontally*; this pushes the cord back a certain distance, so as to draw up the great weight, while the endless cloth cannot run backwards, by reason of a ratchet and click at the end of one of its rollers; the rope, therefore, slips round upon the roller. When the carriage retires, the greater weight turns the roller and advances the endless apron, so as to deliver the card-ends at the same rate as the carriage, by coming out, takes them up; but when the proper quantity is delivered, the knot in the rope arrives at a fixed stop, which does not permit it to move any farther, and at the same instant the roller 5 quits the lever 6, and

allows the upper rail, G, of the clasp to fall, and pinch the card-end fast; the wheel E being then put in motion makes the spindles revolve, and the carriage being drawn out extends the slubbings while under the influence of twisting. In winding-on of the slubbings, the operative must take care to push in the carriage and to turn the wheel round at such rates that the spindles will not take up faster than the carriage moves on its railway.

Thus the essence of Crompton's invention, which was the carriage, became of the greatest importance towards other constructions; as also (when modified in the billy) to the original machine itself, though not primarily intended for this purpose. The long tin-roller, as seen in the jenny and the billy, being difficult to make with the requisite truth of motion for the mule, was replaced by a series of upright drums mounted in the carriage.

The art of spinning with Crompton's machine soon became widely known among work people of all descriptions, from the higher wages which it procured above those of other artisans; such as shoe-makers, joiners, hatters, &c.; many of whom were thereby induced to change their employment, and to become mule spinners. Hence it happened, among this motley gang, that if any thing went amiss with their machine, each of them endeavoured to supply the deficiency with some expedient borrowed from his former trade; the smith introduced a piece of iron, the shoemaker had recourse to leather, and the hatter to felt; whereby valuable suggestions were obtained. The roving department was, however, for some time a distinct business in the hands of those who possessed Arkwright's

system of carding and roving machines, by whom the *roove* was sold to the hand-mule spinners.

Mr. Arkwright had commenced his operations at Nottingham, because he could there obtain tranquillity to work and a demand for his compact yarn in the stocking trade. The whole produce of his machines was for some time absorbed in hosiery. The yarn for this fabric requires to be particularly smooth and equal, in order to pass readily through the needles of the stocking frame. To ensure its possessing this quality in the highest degree, it is spun from two rovings in place of the one used for calico warp; and is hence called *double* spun twist. The introduction of the fine article by Messrs. Need and Strutt produced a vast improvement in the stocking manufacture; it superseded completely the hand spun yarn, and it produced stockings which supplanted the thread ones previously in vogue.

The oldest cotton mill in Manchester is that on Shude Hill, which was erected about the year 1780, by Messrs. Arkwright, Simpson, and Whitenburgh; being one of the numerous speculations into which the active author of the factory system entered. It was remarkable for its motive power, which was a hydraulic wheel furnished with water by a single-stroke atmospheric pumping steam-engine.

In his valuable paper on the rise and progress of the cotton trade, Mr. Kennedy justly remarks that the introduction of Watt's admirable steam-engine imparted new life to this business. Its inexhaustible power and uniform regularity of motion supplied what was most urgently wanted at the time; and the scientific principles and excellent workmanship dis-

played in its construction, led those who were interested in this trade to make many and great improvements in their machines and apparatus for bleaching, dyeing, and printing, as well as for spinning. Had it not been for this new accession of power and scientific mechanism, the cotton trade would have been stunted in its growth, and, compared with its present state, must have become an object of only minor importance in a national point of view.*

The first instance of the application of steam to cotton spinning was at Papplewick, in Nottinghamshire, where Boulton and Watt erected an engine in 1785, for the spirited proprietors Messrs. Robinson. In 1787, they erected one engine for Messrs. Puls, cotton spinners, at Warrington, and three others in Nottingham. Hitherto the hosiery trade gave the principal demand for power-spun cotton. It was not till 1789, that the calico trade of Manchester gave birth to a factory moved by steam, when Mr. Drinkwater mounted a handsome mill with one of Watt's engines. In 1790 Sir Richard Arkwright followed his example, in a mill erected at Nottingham. The same year a second engine, for cotton spinning, was fitted up in Manchester, for Mr. Simpson, and also at Papplewick for Messrs. Robinson. It ought to be mentioned that Sir Richard had tried steam power at an earlier period, but, out of an ill-judged economy, he had adopted Newcomen's machines, rendered rotatory by a heavy fly-wheel; but seeing his error, he replaced them by engines of Watt's construction.

The following detailed narrative of the successive im-

* *Memoirs of the Literary and Philosophical Society of Manchester* vol. iii., 2d series.

provements in mule-spinning, drawn up by one of its greatest masters, both in theory and practice, will be perused with much interest by all who love to trace the mighty streams of our factory wealth up to their fountain head:—(*See also Mule Spinning*, vol. ii. p. 148).

"The introduction of metal rollers and clockwork soon enabled the mule to be extended to a considerable length, up to 100 or 130 spindles, but this extension again was soon at its limit. The tin rollers, which were difficult to make, being ponderous and of great vibration, another contrivance was produced to obviate this inconvenience, viz. by placing vertical cylinders or drums in the carriage. The first attempt was made, as above stated, by Baker of Bury.

"Originally he placed upright pullies in the carriage with nicks to carry six or eight spindles, with the rim-band passing over a pulley upon the vertical shaft, so placed as to give motion to them; this was soon extended to a cylinder or drum as it is now called, (first made in wood, then in tin,) to embrace twenty-four to thirty spindles, the wharves being put on like the strings of a harp to embrace the whole breadth of the drum. By this means the carriage was soon extended to a much greater length, and the better construction of the rollers and their fixtures on the beam, facilitated the enlargement of the whole machine. The greatest improvement was the giving motion to the rollers by a diagonal shaft from the rim to the rollers, which dropped out of geer at the rim when the rollers were to stop. This was also a contrivance of Baker.* By this time, (1786,) there was

* "The bevelled geer was at this time made of wood, probably cut by his own pocket knife.

a great variety of methods for measuring the number of revolutions of the front rollers, in order to give out the required length before the stretching commenced.

"James Hargreaves of Toddington contrived the first method of bringing out the carriage, by a very ingenious invention. It consisted of a parallel scroll, with a small conical one attached to the same, for the band, connected with the carriage, to wind upon; the whole deriving its motion from the wheel axis. Of course there were many contrivances to effect the same purpose, such as a wheel with a pulley upon it, which was forced into a toothed wheel upon the front roller, with a band upon the pulley connected with the carriage, which produced a similar effect, and was disengaged when the rollers were stopped. This was continued for some time; the spinner completing the second draw by the hand and knee, which was more or less, according to the fineness he was spinning.

"The difficulty of obtaining rollers,* spindles, in short all the metal parts of these machines, and the preparing machinery for rovings, added to the want of experienced workmen of every kind, retarded the progress of the spinning trade much less than might be supposed. The fear of over-production then existed, and did exist afterwards from time to time, which caused a suspension of increase of means, and sometimes even a diminution of produce by the means that were in existence. This is the case with every infant trade or manufacture; an obstinate resistance to a reduction of prices existing, until some enterprising

* "Spindles were obtained from the manufacturers of wool combs, and heckles for dressing flax, for the machines of both Hargreaves and Crompton.

spirit attempts to meet the market by some simplification, and better arrangement of the means of production, so as to enable the individual to offer the article produced at a lower price. This principle will hold in all our manufactures, and in such seasons of depression, the greatest improvements have always been made.

"It would be vain to enumerate all the little additions to Crompton's original machine; also, as they arose so much out of one another, it is impossible to give to every claimant what is exactly his due for improvements.* It is therefore only necessary to mention those who have well authenticated claims to the addition of parts of great importance to the machine. But the circumstance of the interval being very short, in making the machine tolerably correct, shews that many heads must have been at work. What led to the enlargement and the forming of the parts of the mule, with additional strength and accuracy, was the application of artificial power, which was first introduced in 1790, by Mr. Kelly, of Glasgow,† formerly of the Lanark Mills. The way in which Kelly applied this artificial power to the usual hand-mule, was simply by a loose pulley, to which a catch was attached, which could be made at pleasure to seize another catch fixed to the axis; on this axis was placed

* "The roving-making then became a distinct business; and in this state the cotton was sold to the little spinners. This was common till power was applied to the turning of the mule. Mills were then built of a suitable width, and in the course of a few years the hand-mule was entirely superseded.

† "Two years after this, he took a patent for a self-acting mule.—See his letter to me, January 8th, 1829, in the *Encyclopedia Britan-*

a screw, which worked into a wheel, the number of whose teeth governed the number of revolutions of the rim, by disengaging the rope from the fast to the loose pulley. Immediately after the introduction of this power, Mr. Wright, an ingenious machine maker of Manchester, an apprentice and workman of Sir R. Arkwright's, constructed the double mule, embracing the advantages of Kelly's application of artificial power. The double mule was constructed by placing the rim in the middle of the frame or rollers. I believe he had four hundred spindles in this mule, and his experiment of its success was with a horse-gin or mill, so that Wright's double mule gradually superseded the use of the single mule; as, by his manner of placing them, the spinner could superintend and operate upon four times the quantity of spindles, compared with the former method.*

"A few years after this, Benjamin Butler, of Bolton, dispensed with the framing of the rim or wheel, extended the axis to the middle of the roller-beam, and connected it by geering with a little coupling shaft, which the front roller coupled each way. The shaft or axis of the rim was engaged and disengaged every stretch, to enable the rim to effect the necessary revolutions of the spindle to complete the thread. To put up the spun thread, he attached a small rim to the carriage about the middle of it, and brought the drum-band over it; thus the little rim was connected with that band which gave motion to the spindles, and had a handle upon it, by which the spinner could govern

* "The squaring band, though insignificant in itself, was of no little importance to the mule. It acts like a parallel rule in guiding out the carriage.

the spindles in the act of wrapping up the thread. This was called the fanny wheel or mule, but since that time various modifications of this kind have been constructed by successive artisans. About 1790, the muslin trade received a great stimulus at Stockport, from the efforts of the late Samuel Oldknow, whose spirit of enterprise extended this branch of our manufacture. He took new ground by copying some of the fabrics imported from India, which at that time supplied this kingdom with all the finer fabrics, and which the mule spun yarn alone could imitate.

"He was very successful in carrying on the ingenious processes which he had devised; but the French revolution creating a panic and general stagnation for a time, he abandoned this branch of the trade, and betook himself to his large water-mill at Mellor, which was built in the year 1790. On his retiring from the manufacturing of fine muslin, Messrs. Horrocks, who had just established themselves at Preston as mule spinners, took up what he had laid down. They became extensive manufacturers of cloth, similar to that made by Oldknow, and supplied the same market, London. This gave a new stimulus in that district, and immediately upon the subsiding of the panic caused by the French revolution, a market sprung up on the Continent for yarns of all kinds, but principally for muslin yarns, up to the highest numbers that could be produced. This gave a general stimulus all through the kingdom, and Watt's and Savary's steam-engine supplied power for the mule spinner, which was soon generally embraced instead of Kelly's application of water power, the use of which can only be local.

"The mule spinning now took the lead, and became

important and extensive. The profits being very considerable the increase was rapid. It was not until 1793 that any attempts were made in spinning fine yarns, say from 100 hanks upwards, by power, when I observed the process very carefully. The rollers, according to the fineness of the thread, would only admit of a certain velocity per minute, for instance, with 200[ds] the rollers could only go at the rate of twenty-five or twenty-six per minute, and the spindle about 1,200. But when the rollers ceased to move, then the spindle was accelerated by the spinner to nearly double its former speed. In what manner the acceleration of the speed of the spindle might be effected by machinery without the aid of the spinner, was suggested to me, by observing in Mr. Watt's steam engine, that one revolution of the beam, (if I may use the expression,) acting upon the fly-wheel by means of the sun and planet wheel, produced a double velocity.

"The difficulty, however, of making the necessary apparatus at that time, induced me to use the more complicated method of four wheels of unequal sizes for producing the same effect. The description is as follows:—Two of the wheels were less and two larger; upon the rim-axis were placed one of the small and one of the large, and the two others were fixed in a frame which carried the axis upon which they were placed, and which had a shank or axis growing to it. This was placed in a vertical position, so that when the carriage was put up, an arm projecting from this vertical shank was connected by a wire with a catch which kept the lying shaft that turned the rollers in geer. In the elongating process the smaller wheel was in contact

with the larger wheel upon the rim, but when, by the disengagement of the catch, the rollers became still or stationary, at that moment the larger wheel, by means of a weight, came in contact with the lesser wheel upon the rim or axis, to which it communicated a double velocity. The shaft with its large and small wheels working alternately, had a pulley with a catch upon it, and was driven by the mill work, and was forced into a corresponding catch upon the said little shaft when the mule was to be set in motion by the steam power (the power in this instance was Savary's). There was a worm upon the rim axis with a wheel upon it, the number of whose teeth determined the revolutions of the rim, as described in Kelly's single speed.

"The second drawing, which had generally been performed by hand, had also to be performed by the machine itself. This had been done in a few instances before power had been applied. From the simplest of these methods I took the hint; by driving a shaft from the rim, by a strap from a small pulley upon the rim-axis, and a large one upon the little axis, which had a small pinion upon it; so that when the drawing-out wheel and band were disengaged from the front roller, they fell back into the little pinion, whose axis was revolving at a very slow speed, and consequently gave a much slower speed to the second stretch or draw, (as it was called,) the speed of which was more or less according to the numbers to be spun. Messrs. A. & G. Murray at that time (like myself and partners) were machine makers, and to a small extent were engaged in fine spinning by hand. They fitted up, on the principle described, a few pairs of hand mules, which they had previously made, wherein

they adopted these contrivances, for one of their customers in Derbyshire, who had artificial power.

"Mr. Drinkwater, of Manchester, was the most extensive fine spinner at the time of which I speak. He was one of the early water spinners, and in possession of the most perfect system of roving making. His large mill in Piccadilly was filled with mules of 144 spindles, each of which was worked by men's hands.

"Mr. Owen was then his manager, and they came to see the new machine in 1793. They approved of it, and thought it practical. Mr. Humphries, of Glasgow, who was a good mechanic, and succeeded Mr. Owen as manager, also approved of the scheme, and got instructions to apply this system of power to his fine work produced by the mules in Piccadilly mill; and, to make its advantages available, he coupled these 144 together, so that he saved one-half of the steam geering, and obtained a reduction in the price of spinning, the spinner having double the number of spindles to operate upon. Mr. H. made an improvement in the four wheels already described, by keeping them always in geer with a loose clutch between the two wheels on the rim shaft, which was alternately fastening the little driving wheel, and then relieving it and fastening the larger, which accelerated the speed of the rim, with a loose pulley as already described in my first. This prevailed for some years, when I thought that this might be simplified, which was done by adopting three pullies, namely one on the small wheel, and another on the larger wheel, with a loose pulley; and by removing the driving strap, which was on the loose pulley when the mule was at rest, to the pulley on the smaller wheel when the rollers were to work. Then the strap was removed to the pulley on

the larger wheel, which accelerated the rim and spindles until the thread was completed, and the strap being removed to the loose pulley, the whole machine came to rest, and the thread was put up by the spinner in the ordinary way. I was now able to construct the sun and planet wheel for the acceleration of the speed of the spindle, which was as follows:—the sun and planet wheel had only two wheels and one pulley, with a clutch that fastened the sun wheel, when the accelerated motion was required. Many other modifications were introduced, but the four wheels prevailed, some of which for convenience I constructed by making them bevils, and placing their axes vertically to get motion from an upright shaft, which produced the same effect as the spur wheels. This was suggested to me by Mr. Lee of Salford, and I made him a model of one in 1800.

"Having thus briefly explained the principal modifications of fine spinning by power; I have only to add, that they produced a great change in the value of the fine yarn, and, consequently, a great extension of its use. The Scotch in Lanarkshire and Renfrewshire, being long in the habit of weaving fine cambric from flax yarn and silk gauzes, had also turned their hands to the manufacture of fine cotton fabrics, principally from the fine yarns produced by Hargreaves's, and other subsequent machines. The Lancashire manufacturers followed them in the thicker and firmer fabrics"*

What a warning voice does the fate of Hargreaves

* A Brief Memoir of Samuel Crompton, by John Kennedy, Esq. Read before The Literary and Philosophical Society of Manchester, February 20th, 1830.

and Crompton send forth to inventors and improvers of the useful arts! how strongly does it justify the sound sense and self-respecting energy of Arkwright! Until man, the slave of selfishness, be regenerated by the spirit of Christian philanthropy, it is folly akin to fatuity for an industrious operative to surrender to the comparatively rich, without a fair equivalent, the fruits of his ingenious toils in hopes of requital from the world at large. How absurd such expectations are, we daily see exemplified in the scandalous effrontery with which avarice appropriates to its insatiable desires discoveries which its dark spirit could never have elicited, acting in defiance, not merely of honour and honesty, but of the most positive sanctions of law. What shabby tricks, nay, what infamous perjury does not almost every case of patent litigation display!

No contrivance was better entitled to the reward of an exclusive privilege for a certain number of years than the mule of Crompton. How many individuals, far his inferior in mechanical, moral, and intellectual merit, has it enriched! Had he received but 1*s*. per annum for each spindle worked on his elegant plan during fourteen years, a contribution which no honest manufacturer should have grudged, such an income would have been placed at the disposal of the worthy contriver, as, while it provided him with a dignified independence, would have done honour to his compatriots, and have encouraged genius in every coming age. It is, in fact, as much for the interest of society, to protect property in invention, as under any other form.

Some idea may be had of the pecuniary value of Crompton's machine, even in its rudest state, from the following facts:—Immediately on completing it, in

1775, he obtained 14*s*. per pound for the mere preparation and spinning of No. 40, whereas, in 1833, a pound of No. 40 mule-weft could be bought for 1*s*. altogether, of which the cotton wool cost 8*d*., leaving only 4*d*. for spinning. The price now paid for spinning one pound of cotton into thirty-six hanks weft, and returning one pound of yarn, (there being one ounce and a half waste per pound,) is only *five pence!** A short time after the above date, Crompton was paid £1 5*s*. for spinning a pound of yarn, No. 60, and at the rate of £2 2*s*. a-pound for a small experimental quantity of No. 80; in 1786, 10*s*. a-pound were paid for the mere spinning, exclusive of the preparation, of No. 100, but in 1790 the price fell to less than 4*s*.; about 8*d*. per pound is now paid for the spinning and preparation of such yarn.

The first water-mill erected in Ireland for spinning cotton twist was built in the neighbourhood of Belfast. In the year 1771, at which time there was not a single cotton-loom in the whole north of Ireland, the late Robert Joy conceived the scheme of introducing into that then desponding kingdom the cotton manufacture, which has proved a source of industry and considerable opulence to the sister island. Having, in conjunction with Thomas M'Cabe, suggested that the spinning of cotton yarn might, as an introductory step to the establishment of the manufacture, be a fit and profitable employment for the children in the Belfast poor-house, several of them were set to work on the common wheel; but the novel machinery in England, giving that country so great a superiority, it was

* Mr. George Smith—Committee on Manufactures, p. 569.

found that no benefit could be gained without the introduction of it there. A spinning machine was therefore made in Belfast, under the direction of Mr. N. Grimshaw, cotton and linen printer from England, who had some time before settled in Ireland; and shortly after, an experienced spinner was brought over by Mr. Joy, from Scotland, to instruct the children in the poor house; also, under the same direction, and at the expense of the gentlemen mentioned, a carding machine was erected at Mr. Grimshaw's, to go by water, which was afterwards removed to the poor house, and wrought by hand. A firm was now formed of the original projectors and others, under the name of Joys, M'Cabe, and M'Cracken, who contracted with the same charitable institution for the employment of a number of its children, as well as for the use of its vacant rooms. They also dispatched a skilful mechanic to England, who, at personal risk and considerable expense, procured a minute knowledge of the improved machinery there, which the proprietors and inventors wished to have kept secret from the continent as well as Ireland. But so far from confining their hopes of gain to themselves, these gentlemen encouraged the public to avail itself of their improvements; they exposed the machinery to open view, permitted numbers even from distant parts to be taught in their apartments, without any charge for such indulgence, and promoted the progress of the manufacture of cottons, dimities, and Marseilles-quilting, equally by example and instruction. These exertions were in time followed on an enlarged scale by Messrs. Nathaniel Wilson and Nicholas Grimshaw; to the talents, property, and adventurous spirit of the former

of these gentlemen, and to the practical knowledge, genius, and industry of the latter, Ireland stands very highly indebted. The first mill for spinning twist by water there was built by them in the year 1784, from which year the Irish cotton manufactures were considered to be firmly established.

In the year 1800, only twenty-three years from the origin of the enterprise by Joy and M'Cabe, it appeared in evidence before Parliament that the cotton manufacture which they had thus introduced gave employment to 13,500 working people, and including all manner of persons, occupied in various ways, to 37,000, within a circuit of only ten miles, but comprehending within its bounds the towns of Belfast and Lisburn. In less than ten years from their first introduction into the country, several thousand looms were employed in the manfacture of cotton in the towns of Belfast, Lisburn, and Hillsborough; at present there are eight very large cotton mills in Belfast and its immediate vicinity, and seven others in different neighbouring towns; and, although it be difficult to estimate the number of hands engaged in these mills, it is calculated that those in and about Belfast, give employment to 30,000 individuals.*

At the period of the remarkable development of the cotton trade in 1787, it happened, unluckily for the British manufacturers, that the East India Company had a very great stock of piece goods in their warehouses, which caused a general depreciation of their value; the manufacturers became alarmed, and presented to the Committee of the Privy Council

* Hardy's Northern Tourist.

for Trade a memorial, charging the said Company with having augmented the quantity of their imports of cotton fabrics, and with lowering their prices, in order to ruin the home establishments, and destroy British industry in favour of their subjects in Hindostan and of their European commerce.

The accusation being transmitted by the Committee of the Privy Council to the Company, it received so complete an answer as to convince the Committee that if any restrictions were imposed on the Company's sales, their trade would be thrown into the hands of foreigners, and thereby give occasion to very extensive smuggling for home consumption. And, indeed, when we consider that these East India goods were always sold by public auction, it is evident that the demand must regulate the price, which is fixed by the buyers themselves, for the Company would always take the highest price they could obtain. Neither was the glut of goods which now overwhelmed the market, and pressed so hard upon the manufacturers of small capital, permanently hurtful to the cotton trade, but, on the contrary, of the greatest eventual advantage, for it caused a vast number of new channels of sale and consumption to be opened, thus diffusing a taste for those fine fabrics in the remotest villages of the kingdom, where they had been quite unknown before. Hence the way was paved for a widely extended demand for the productions of both the British and the Indian workshops, by which the regular sales were increased twenty-fold. Women of all ranks, from the highest to the lowest, began to be clothed in British cotton manufactures, from the muslin cap upon the crown of their head to the stocking under the sole of their foot.

The taste and skill of the calico printers kept pace with the ingenuity of the spinners and weavers, and produced patterns of coloured goods, exceeding, in beauty and durability of wear every thing imported from the East.

On occasion of the abovementioned panic a pamphlet was published, to warn the country of its danger, from the competition of the East Indies in the cotton trade. The author of this work seems as a partisan to have greatly exaggerated the extent of the business at the time, and must therefore be followed with many modifications. He states that about the year 1768 the whole cotton trade of Great Britain did not return £200,000 to the country for the raw material, combined with the labour of the people, and that before the introduction of the jenny and water twist-machines the production of the single-thread wheel could not exceed that of 50,000 spindles. Here he certainly underrates the extent of the manufacture, for at the period in question 4,000,000 lbs. of cotton wool were consumed per annum, and their value must have been more than doubled by labour, constituting a total value of at least £500,000.

In 1787 the number of cotton spinning-mills in England and Wales is rated by the pamphlet writer at 145, and their cost at £715,000, an amount much beyond the truth; for, though many mills were worth more than £5,600, yet that sum certainly far exceeded their average value. There were said to be at the same time 550 mule frames and 20,700 jennies, containing, together with the water-twist frames, 1,951,000 spindles, the cost of which, and of the auxiliary machinery, was

reckoned to have been at least £285,000, constituting a total value vested in spinning mills of £1,000,000 sterling.

These establishments, when in full activity, were estimated by him to be capable of producing as much cotton-yarn as 1,000,000 persons could spin when diligently employed at the domestic wheel; yet, instead of diminishing the occupations of the people, as had been apprehended, they gave vast numbers the means of a comfortable livelihood.

Spinning and its subsidiary labours gave employment, according to the same pamphleteer, to

26,000 men, 31,000 women, and 55,000 children;

Weaving, calico-printing, &c., gave employment to

133,000 men, 59,000 women, and 48,000 children:

making an aggregate of

159,000 men, 90,000 women, and 101,000 children;

or of 350,000 individuals altogether.

If we take one-half of the above numbers we shall be tolerably near the truth.

The cotton wool imported in the year 1787 amounted to 23,250,268 lbs., whereas in 1781 it was little more than 5,000,000. The cotton consumed in the manufactures of 1787 was of the following descriptions:—

British West India . estimated at	6,600,000 lbs.
French and Spanish Colonies . .	6,000,000
Dutch Colonies	1,700,000
Portuguese ditto	2,500,000
East India, *via* Ostend	100,000
Smyrna and Turkey	5,700,000
	22,600,000

The distribution of the raw material among the different manufactures was estimated to be as follows :—

Candle-wicks	1,500,000 lbs.
Hosiery	1,500,000
Silk and linen mixtures . . .	2,000,000
Fustians	6,000,000
Calicoes and muslins . . .	11,600,000
	22,600,000

The weight of the manufactured articles would be less by fully 10 per cent. from waste in the processes.

It is a curious fact that muslins were manufactured at Zurich and St. Gall, in Switzerland, long before they were made in this country; but, when our mule-jennies came into play, they soon enabled England to outstrip and crush all foreign competitors in that fine fabric. It has been computed that in the year 1787 not less than 500,000 pieces of muslin, with shawls and handkerchiefs, were produced in Great Britain.

Muslin weaving was attempted at Paisley so long ago as the year 1700, but it was soon suppressed, in consequence of the large importations of that article from India. The germ, after lying dormant for eighty years, rapidly expanded into a flourishing business, showing a singular aptitude in the people of that town for this elegant branch of the cotton trade.

CHAPTER II.

General View and Analysis of a Modern Cotton Factory.

There is no textile substance whose filaments are so susceptible of being spun into fine threads of uniform twist, strength, and diameter, as cotton wool. It derives this property from the smoothness, tenacity, flexibility, elasticity, peculiar length, and spiral form of the filaments; hence, when a few of them are pulled from a heap with the fingers and thumb, they lay hold of and draw out many others. Were they much longer they could not be so readily attenuated into a fine thread, and were they much shorter the thread would be deficient in cohesion. Even the differences in the lengths of the cotton staple are of advantage in adapting them to different styles of spinning and different textures of cloth.

If we take a tuft of cotton wool in the left hand, and, seizing the projecting fibres with the right, slowly draw them out, we shall perceive with what remarkable facility they glide past each other, and yet retain their mutual connexion, while they are extended and arranged in parallel lines, so as to form a little riband, susceptible of considerable elongation. This demonstration of the ductility, so to speak, of cotton wool, succeeds still better upon the carded fleece, in which the filaments have acquired a certain parallel-

ism; for in this case the tiny riband, in being drawn out by the fingers to a moderate length, may, at the same time, receive a gentle twist, to preserve its cohesion, till it becomes a fine thread.

Hence we may imagine the steps to be taken or the mechanical processes to be pursued in cotton-spinning. After freeing the wool of the plant from all foreign substances of a lighter or a heavier nature, the next thing is to arrange the filaments in lines as parallel as possible, then to extend them into regular ribands, to elongate these ribands by many successive draughts, doubling, quadrupling, or even octupling them meanwhile, so as to give them perfect equality of size, consistence, and texture, and at the same time to complete the parallelism of the fibres by undoing the natural convolutions they possess in the pod. When the rectilinear extension has been thus carried to the fineness required by the spinner, or to that compatible with the staple, a slight degree of torsion must accompany the further attenuation; which torsion may be either momentary, as in the tube roving machine, or permanent, as in the bobbin-and-fly frame. Finally, the now greatly attenuated soft thread called a *fine roving* is drawn out and twisted into finished cotton yarn, either by continuous indefinite gradations of drawing and twisting, as in the throstle, or by successive stretches and torsions of considerable lengths at a time, as in the mule.

Mechanical spinning consists in the suitable execution of these different processes by a series of different machines. After the carding operation, these are made to act simultaneously upon a multitude of ribands and spongy cords or threads by a multitude of

mechanical hands and fingers. However simple and natural the above described course of manufacture may appear to be, innumerable difficulties stood for ages in the way of its accomplishment, and so formidable were they as to render their entire removal of late years in the cotton factories of England one of the greatest and most honourable achievements of human genius.

The modern art of spinning cotton by machinery, which has long since supplanted that by the hand-wheel throughout civilized Europe and America, consists of the following operations:—

1. The *cleaning* and opening up or loosening the flocks of cotton wool, as imported in the bags, so as to separate at once the coarser and heavier impurities as well as those of a lighter and finer kind.

2. The *carding*, which is intended to disentangle every tuft or knot, to remove every remaining impurity which might have eluded the previous operation, and finally to prepare for arranging the fibres in parallel lines, by laying the cotton first in a fleecy web, and then in a riband form.

3. The *doubling* and *drawing out* of the card-ends or ribands, in order to complete the parallelism of the filaments, and to equalize their quality and texture.

4. The *roving* operation, whereby the *drawings* made in the preceding process are greatly attenuated, with no more twist than is indispensable to preserve the uniform continuity of the spongy cords; which twist either remains in them, or is taken out immediately after the attenuation.

5. The *fine roving* and *stretching* come next; the

former operation being effected by the fine bobbin-and-fly frame, the latter by the stretcher mule.

6. The *spinning* operation finishes the extension and twist of the yarn, and is done either in a continuous manner by the water twist and throstle, or discontinuously by the mule; in the former the yarn is progressively drawn, twisted, and wound upon the bobbins; in the latter it is drawn out and twisted in lengths of about 56 inches, which are then wound all at once upon the spindles.

7. The seventh operation is the *winding*, doubling, and singeing of the yarns, to fit them for the muslin, the stocking, or the bobbin-net lace manufacture.

8. The *packing-press*, for making up the yarn into bundles for the market, concludes this series.

9. To the above may be added the operations of the dressing-machines, and,

10. The power-looms.

The site of the factory ought to be carefully selected in reference to the health of the operatives, the cheapness of provisions, the facilities of transport for the raw materials, and the convenience of a market for the manufactured articles. An abundant supply of labour, as well as fuel and water for mechanical power, ought to be primary considerations in setting down a factory. It should therefore be placed, if possible, in a populous village, near a river or a canal, but in a situation free from marsh malaria, and with such a slope to the voider stream as may ensure the ready discharge of all liquid impurities. These circumstances happily conspire in the districts of Stockport, Hyde, Stayley Bridge, Duckenfield, Bury, Blackburn, &c., and have eminently favoured the rapid extension of the cotton manufactures for which these places are pre-eminent.

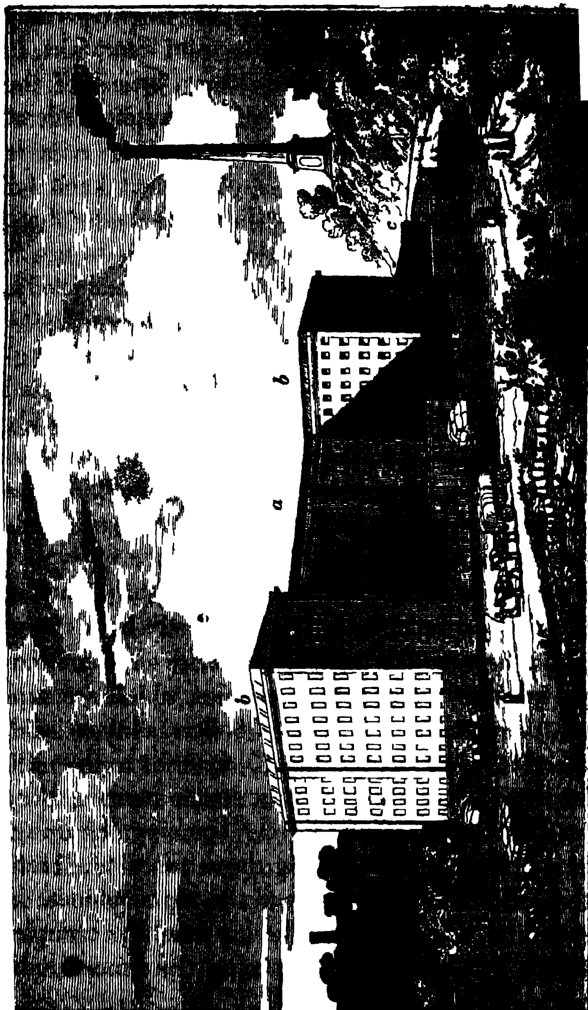

Fig 21.—Perspective View of a modern Cotton Factory. Mr Orrell's Great Mill, near Stockport.

The situation chosen by Mr. Orrell for the factory represented in perspective in fig. 21 is particularly good. It stands about half a mile from Stockport, in a beautiful meadow, stretching along a branch of the Mersey, the grand river feeder of the cotton trade of England. At a little distance the ground rises in gentle eminences, and affords a convenient knoll for sustaining the great chimney stalk of the boiler flues, sufficiently distant from the spinning factory to free it entirely from smoke. The mill consists of a main body, *a*, with two lateral wings, *b*, *b*, projecting forwards, the latter being appropriated to store-rooms, a counting-house, rooms for winding the yarn on bobbins, and other miscellaneous purposes. The building has six floors, besides the attic story. The ground plan comprehends a plot of ground 280 feet long by 200 feet broad, exclusive of the boiler sheds, or the low building seen to the right hand in the perspective view.*

The right-hand end A, plate I†, of the principal building, is separated from the main body by a strong wall, and serves in the three lower stories for accommodating two ninety-horse steam-engines, which are supplied with steam from a range of boilers, as above said, contained in a low shed, *c*, fig. 15, exterior to the mill.

The three upper stories over the steam-engine gallery are used for unpacking, sorting, picking, cleaning, willowing, batting, and lapping the cotton wool. Here are the willow, the blowing, and the lap machines, in a descending order, so that the lap machine occupies the lowest of the three floors, being thus most judi-

* The artist has taken a little licence in the sketch, by giving it seven stories instead of six.

† See plate I, at the end of the volume.

ciously placed on the same level with the preparation-room of the building. On the fourth main floor of the factory there are, in the first place, a line of carding engines arranged, near, and parallel to, the windows, as shown at B, B, in the ground plan, plate I; and, in the second place, two rows of drawing frames, and two of bobbin-and-fly frames, in alternate lines, parallel to each other, as indicated by D, C, D, C, for the drawing frames, and E, E, E, E, for the bobbin-and-fly frames in the ground plan. The latter machines are close to the centre of the apartment.

The two stories next *under* the preparation-room are occupied with throstle frames, distributed as shown at F, F, in the ground plan. They stand in pairs alongside of each other, whereby two may be tended by one person. These principal rooms are 280 feet long, and nearly 50 feet wide. The two stories *over* the preparation-room, viz., the fifth and sixth floors from the ground, are appropriated to the mule jennies, which are placed in pairs fronting each other, so that each pair may be worked by one man. Their mode of distribution is shown at G, G, in the ground plan. The last single mule is seen standing against the end wall, with its head-stock projecting in the middle.

The ground floor of the main building, as well as the extensive shed abutted behind it, marked by N, H, H, in the plan, is devoted to the power-looms, the mode of placing which is plainly seen at H, H, H.

The attic story accommodates the warping mills, and the warp dressing machines subservient to power-weaving.

The winding machines, and some extra mules (self-

actors), are placed in the wings; the five winding machines being in the two top rooms of the left wing.

We shall briefly sum up the references in the ground plan as follows:—

A, the grand apartment for the steam-engines.

B, the distribution of the carding engines, the moving shaft or axis running in a straight line through them, with its pulleys for receiving the driving bands.

C, C, the drawing frames.

D, D, the jack, or coarse bobbin-and-fly frames.

E, E, the fine roving or bobbin-and-fly frames.

F, the arrangement of the throstle frames, standing in pairs athwart the gallery, in the second and third flats.

G, the mules are here represented by their roller beams, and the outlines of their head-stocks, as placed in the fifth and sixth stories.

H, the looms, with their driving-pulleys projecting from the ends of their main axes. Sometimes the looms are placed in parallel straight lines, with the rigger-pulleys of the one alternately projecting more than the other, to permit the free play of the driving-belts; sometimes the looms are placed, as generally in this engraving, alternately to the right and left, by a small space, when the pulleys may all project equally. The former plan is the one adopted in Mr. Orrell's mill.

I, represents the cast-iron girders which support the floors of this fire-proof building.

K, K, are closets placed in each floor, in the recesses of a kind of pilasters built against the outside of the edifice. These hollow shafts are joined at top by horizontal pipes, which all terminate in a chest con-

nected with the suction axes of a fan, whereby a constant draught of air circulates up the shafts, ventilates the apartments, and prevents the reflux of offensive effluvia from the water-closets, however careless the work-people may be. The tunnels towards the one end of the building are destined for the men—towards the other for the women.

L, L, are the staircases, of a horse-shoe form, the interior space or shaft in the middle being used for the teagle or hoist, as figured and described at page 47, *et. seq.*, of the "Philosophy of Manufactures." In the posterior part of the shaft a niche or groove is left for the counterweight to slide in, out of the way of the ascending and descending platform.

M, M, are the two porters' lodges, connected to the corner of each wing by a handsome iron balustrade. They are joined by an iron gate.

It will be observed that the back loom-shed has only one story, as shown in section plate 2.

In the ground plan of the shed,

N represents the roofing, of wood-work.

The rafters of the floors rest at their ends upon an iron plate, or shoe with edges (as it is called), for the girders to bear upon.

The two steam-engines, of fully ninety-horse power each, operate by cranks, which stand at right angles upon the shaft marked *a*, both in the plan and section plates 1 and 2. In the centre, between the bearings, is a large cog-wheel, driving a smaller one upon the shaft marked *b* in both plates, to which the fly-wheel *c* belongs. That prime motion wheel is magnificent, and possesses a strength equal to a strain of 300 horses. From this shaft motion is given to the main

or upright shaft *d* in the section by two bevel-wheels, visible at the side and on the top of the great block of stone, about five tons weight, plate 2, which gives a solid basis to the whole moving apparatus.

The velocity of the piston in these steam-engines is 240 feet per minute.

The first shaft makes 44·3 revolutions per minute.

The main upright shaft 58·84 ditto, ditto.

The steam-engines make 16 strokes per minute; and the length of their stroke is 7 feet 6 inches.

As the one engine exerts its maximum force when the other has no force at all, and as the one increases as the other diminishes in the course of each pair of strokes, the two thus co-operate in imparting an equable impulsion to the great geering and shafts, which, being truly made, highly polished, and placed in smooth bearings of hard brass, revolve most silently and without those vibrations which so regularly recurred in the older factories, and proved so detrimental to the accurate performance of delicate spinning-frames.

To the horizontal ramifications from the upright shaft any desired velocity of rotation may be given by duly proportioning the diameters of the bevelled wheels of communication between them: thus—if the wheel on the end of the horizontal shaft have one-half or one-third the diameter of the other, it will give it a double or a triple speed.

In the lowest floor the second bevel-wheel above the stone block drives the horizontal shaft *e*, seen in the ground plan; and thereby the horizontal shaft *f*, at right angles to the former, which runs throughout the length of the building, as the other did through its

breadth, backwards. The shaft *f* lies alongside of the back-window wall, near the ceiling; and from it the transverse slender shafts proceed to the right and left in the main building, and to the shed behind it, each of them serving to drive two lines of looms. These slender or branch shafts are mounted with pulleys, each of which drives four looms by four separate bands.

In the second and third floors, where the throstles are placed, the shaft *d* is seen in the section plate to drive the following shafts :—

Upon the main upright shaft, *d*, there are in each of these stories two horizontal bevel-wheels, with their faces fronting each other (shown plainly over *d, d*), by which are moved two smaller vertical bevel-wheels, on whose respective axes are two parallel shafts, one over each other, *g, g*, which traverse the whole length of the building. These two shafts move therefore with equal velocities, and in opposite directions. They run along the middle space of each apartment; and wherever they pass the rectangular line of two throstle frames (as shown at F in the ground plan) they are each provided with a pulley; while the steam-pulleys on the axes of two contiguous throstles in one line are placed as far apart as the two diameters of the said shaft-pulleys. An endless strap goes from the pulley of the uppermost horizontal shaft, *g*, round the steam or driving pulley of one throstle frame; then up over the pulley of the second or lower shaft, *g*; next over the steam-pulley of a second throstle; and, lastly, up to the pulley of the top shaft, *g*.—See *g, g*, in the throstle floors of the cross section, plate 2.

In the preparation-room three horizontal shafts

are led pretty close to the ceiling, through the whole length of the building. The middle one, *h*, (see the plan, plate I.), is driven immediately by bevel-wheels from the main upright shaft, *d*, (plate 2.) The two side ones, *i*, *i*, which run near the window walls, are driven by two horizontal shafts, which lead to these side shafts. The latter are mounted with pulleys, in correspondence with the steam-pulleys of the two lines of carding-engines, as seen between the cards in the plan. The middle shaft, *h*, drives the two lines of bobbin-and-fly frames, E, E, E, E, (see cross section); and short shafts, *i*, *i*, seen in the cross section o this floor, moved from the middle shaft, *h*, turning in gallows fixed to the ceiling, over the drawing and jack frames, give motion to the latter two sets of machines. See C, D, in the cross section, plate 2.

To drive the mules in the uppermost story, a horizontal shaft, *k*, (see longitudinal and cross sections, as well as ground plan,) runs through the middle line of the building, and receives motion from bevel-wheels placed on the main upright shaft, *d*, immediately beneath the ceiling of the uppermost story. From that horizontal shaft *k*, at every second mule, a slender upright shaft, *l*, passing through both stories, is driven. (See both sections). Upon these upright branch-shafts are pulleys in each story, one of which serves for two mules, standing back to back against each other. To the single mules at the ends of the rooms the motions are given by still slenderer upright shafts, which stand upon the head-stocks, and drive them by wheel-work, the steps (top bearings) of the shafts being fixed to brackets in the ceiling.

In the attic, a horizontal shaft, *m*, *m*, runs length-

wise near the middle of the roof, and is driven by wheel-work from the upright shaft: this shaft, m, gives motion to the warping-mills and dressing machines.

This cotton-mill having been recently erected, according to plans devised and executed by that very eminent engineer Mr. Fairbairn, of Manchester, may be justly reckoned a model of factory architecture. It was calculated for, and will be mounted with, eleven hundred power-looms, of which one hundred require steam-power equivalent to twenty-five horses to impel them, inclusive of the preparation and spinning operations competent to supply the looms with yarn. A third steam engine will be added.

Ten looms, with the requisite dressing, without spinning, are considered to be equivalent to one horse's power in a steam-engine.

Steam-power equivalent to one horse will drive

500 mule spindles,
300 self-actor spindles,
180 throstle spindles, of the common construction,

in which estimate the requisite preparation processes are included.

	Spindles.
In Mr. Orrell's mill there are 6,474 spindles in each of the throstle-frame floors,	12,948
And fourteen pairs of mules in each of the two mule floors—containing altogether	24,928
Nineteen self-actors in the wing—containing	7,984
Total yarn spindles	45,860

One of the most compact and best-regulated mo-

dern factories, on the small scale, which I visited in Lancashire, consisted of the following system of machines:—

One willow, one blowing machine, one lap machine, capable, together, of cleaning and lapping 9,000 pounds of cotton per week, if required.

Twenty-one cards, breakers, and finishers, which carded 5,000 pounds of cotton every week of 69 hours' work; being about 240 pounds per card.

3 drawing frames, of 3 heads each.
3 coarse bobbin-and-fly frames.
7 fine do. do. No stretcher mule.
12 self-actor mules, of Sharp and Roberts's construction, of 404 spindles each = 4,848 mule spindles.
10 throstle frames, of 236 spindles each = 2,360 spindles.
7 dressing machines.
236 power-looms.
2 warping-mills.
300 winding spindles for winding the warp.

The rovings have four hanks in the pound, and are spun into yarn No. 38, on the throstle, as well as the mule.

One bobbin of the roving (compressed) lasts five days on the self-actors, and six days on the throstles.

According to the estimate of Peile and Williams, of Manchester, 66 horses' power of a steam-engine are equivalent to 396 power-looms, including 16 dressing machines; the cloth being 36 inches wide upon the average; and the yarn varying in fineness from 12's to 40's, the mean being 26's. Here, the spinning and preparation not being included, the allowance of power

will appear to be high. The estimate given above assigns ten looms, with the requisite dressing, to one horse; but the latter assigns no more than six.

For the following experimental results, carefully made with an improved steam-engine *indicator*, upon the principle of Mr. Watt's construction, I am indebted to Mr. Bennet, an eminent engineer in Manchester. His mode of proceeding was to determine, first of all, the power exerted by the factory steam-engine when all the machines of the various floors were in action; then to detach, or throw out of geer, each system of machines, and to note the diminution of force now exercised. Finally, when all the machines were disengaged, he determined the power requisite to move the engine itself, as well as the great geering wheels and shafts of the factory.

He found at the factory of J. A. Beaver, Esq., in Manchester, that

500 calico-looms (without dressing) took the power of 33 horses, which assigns 15 looms to one horse power.

At Messrs. Birlie's factory, in Manchester, he found that

1,080 spindles in 3 self-actor mules took 2.59 horses, being 417 spindles for one horse power; that

3,960 spindles in 11 self-actors took 8.33 horses, being 475 spindles, per horse power;

1,080 spindles in 3 self-actors took 2 horses, being 540 spindles, per horse.

At Messrs. Clarke and Sons', in Manchester, that

585 looms for weaving fustians of various breadths took 54 horses' power, exclusive of dressing machines: being 11 looms to 1 horse.

At J. A. Beaver's, on another occasion, he found that
1,200 spindles, of Danforth's construction, took 21 horses, being 57 spindles per horse power; and that in a second trial the power of 22 horses was required for the same effect; being 54 Danforth spindles per horse power.

An excellent engine of Messrs. Bolton and Watt, being tried by the indicator, afforded the following results in a factory:—

A 60-horse boat-engine (made as for a steam-boat) took $14\frac{1}{2}$ horses' power to drive the engine with the shafts . . .	14.5
$3\frac{1}{2}$ blowing machines, with their three fans	21.55
10 dressing machines	10.25
12 self-actor mules, of 360 spindles each (720 spindles per horse power) . .	6.00
6 Danforth throstle frames; containing 570 spindles (96 in each), being 93 spindles to a horse power	6.20

At Bollington, in a worsted-mill, he found that
$106\frac{1}{2}$ spindles, including preparation, took one horse power upon throstles. N.B. There is no carding in the long wool or worsted manufacture for Merinos.

At Bradford, in Yorkshire, he found that
A 40-horse power boat-engine, of Bolton and Watt's, drove 598 calico-looms,
6 dressing machines (equivalent to dress warp for 180 of the said looms), and
1 mechanic's workshop, which took 2 horses' power.

Other engineers estimate 200 common throstle spindles, by themselves, to be equivalent to the power of one horse.

The shafts which drive the cards revolve about 120 times per minute, with a driving pulley of from 15 to 17 inches in diameter.

The shafts of the drawing, and the bobbin-and-fly frames, revolve from 160 to 200 times per minute, with pulleys from 18 to 24 inches in diameter.

The shafts of throstle frames in general turn at the rate of from 220 to 240 times per minute, with driving pulleys 18 inches in diameter, when they are spinning yarn of from No. 35's to 40's. The shafts of mules revolve about 130 times per minute, with pulleys 16 inches in diameter.

The shafts of power looms revolve from 110 to 120 times per minute, with pulleys 15 inches in diameter.

The shafts of dressing machines revolve 60 times per minute, with pulleys 14 inches in diameter.

Before quitting the generalities of the cotton manufacture I may state the following facts, communicated also by Mr. Benret:—

A waggon-shaped boiler, well set, will evaporate 12 cubic feet of water with 1 cwt. of coals; and a steam-boiler with winding flues will evaporate 17 cubic feet with the same weight of fuel: $7\frac{2}{10}$ pounds of coals to the former boiler are equivalent to a horse's power exerted for an hour, estimating that a horse can raise 33,000 pounds 1 foot high in a minute.

The first cotton-mill upon the fire-proof plan was erected, I believe, by the Messrs. Strutt, at Belper, in the year 1797; that of Messrs. Phillips and Lee, at Manchester, in 1801; that of H. Houldsworth, Esq., of Glasgow, in 1802; and that of James Kennedy, at Manchester, in 1805; since which time all good factories have been built fire-proof, like Mr. Orrell's.

The heating of the apartments of cotton-factories is effected by a due distribution of cast-iron pipes, of about seven or eight inches diameter, which are usually suspended a little way below the ceilings, traverse the rooms in their whole length, and are filled with steam from boilers exterior to the building. It has been ascertained that one cubic foot of boiler will heat fully more than two thousand cubic feet of space in a cotton-mill, and maintain it at the temperature of about 75° Fahr. If we reckon twenty-five cubic feet contents of water in a waggon-shaped steam-boiler as equivalent to a horse's power, such a boiler would be capable of warming fifty thousand cubic feet of space; and therefore a ten-horse steam-boiler will be able to heat five hundred thousand cubic feet of air, from the average temperature, 50° of our climate, up to 75°, or perhaps even to 80°, Fahr.

It has been also ascertained that, in a well-built cotton-mill, one superficial foot of exterior surface of cast-iron steam-pipe will warm two hundred cubic feet of air. In common cases, for heating churches and public rooms, I believe that one-half of the above heating surface will be found adequate to produce a sufficiently genial temperature in the air. The temperature of the steam is supposed to be the same with that in Mr. Watt's low-pressure engines, only a few degrees above 212°,—the boiling point of water.

The pipes must be freely slung, and left at liberty to expand and contract under the changes of temperature, having one end at least connected with a flexible pipe of copper or wrought iron, of a swan-neck shape. Through this pipe the water of condensation is allowed to run off. The pipes should not

be laid in a horizontal direction, but have a sufficient slope to discharge the water. The pipes are cast from half an inch to three quarters thick in the metal. In practice the expansion of steam-pipes of cast iron may be taken at about one-tenth of an inch in a length of ten feet, when they are heated from a little above the freezing to the boiling point of water. The upper surface of a horizontal steam-pipe is apt to become hotter than the bottom, if the water be allowed to stagnate in it; the difference being occasionally so great, as to cause a pipe sixty feet long to be bent up two inches in the middle.

In arranging the steam-pipes provision ought to be made not only for the discharge of the water of condensation, as above stated, but for the ready escape of the air; otherwise the steam will not enter freely. Even after the pipes are filled with steam, a little of it should be allowed to escape at some extreme orifice, to prevent the re-accumulation of air discharged from the water of the steam-boiler. In consequence of water being left in the pipes serious accidents may happen; for, the next time the steam is admitted into them, the regularity of heating and expansion is impeded, some part of the pipe may crack, or a violent explosion may take place, and the joints may be racked to a very considerable distance, every way, from the place of rupture, by the alternate expansions and condensations. The pipes should therefore be laid, so as to have the least possible declivity, in the direction of the motion of the steam.

Formerly, when drying-rooms in calico print works were heated by iron stoves, or cockles, their inmates were very unhealthy, and became emaciated; since

they have been heated by steam-pipes the health of the people has become remarkably good, and their appearance frequently blooming.

The following analytical estimate exhibits the equipment and cost of two of the most recent and complete cotton factories in England.

1st. Mr. Orrell's mill, when mounted, as it will presently be, with 1,100 power-looms and a third steam-engine, will have cost £85,000. It will contain the following system of machines.

I. Cotton cleaning machines:

	Revolutions per minute.
1. Two of Lillie's great conical willows; speed of steam pulley	350
2. Five blowing or scutching machines	1,600
3. Five lapping machines	1,600

II. Preparation machines:

1. 168 carding engines	114
2. Twenty-four drawing frames.	
	Spindles.
3. Twenty-four coarse bobbin-and-fly frames, containing	1,152
4. Fifty fine bobbin-and-fly or jack frames	3,204

III. Spinning machines:

1. Seventy-eight throstle frames, containing 12,948 spindles, which are capable of producing 9,000 lbs. of from 36's to 40's in a week of 69 hours, being at the rate of 25 hanks of 38's per spindle in that time.

	Spindles.		lbs.
2. Fifty-six hand mules, containing	24,928,	producing	18,000
Nineteen self-actors, ,,	7,984,	,,	7,000
	32,912		25,000

Total spindles, 45,860

3. The hand mules produce 26 hanks of 36's in 69 hours.
The self-actors produce 31½ ditto ditto.

4. Five winding machines of 1,200 spindles, which are placed in the two uppermost rooms of the left wing.
5. 1,100 power-looms, averaging each 5¾ pieces in 69 hours' work, with a speed of 120 picks per minute. In another factory, in Stockport, several of the same looms are working well at the rate of 130 picks per minute.
6. Thiry-two dressing machines.

For driving the whole of the above machines a power of 250 horses is required.

	s.	d.	
The price of warp-yarn 36's is	1	6½	per lb.
Ditto weft-yarn ,,	1	4	,,
The cotton-wool of the warp costs	0	11	,,
Ditto of the weft costs	0	9¾	,,

The prices now received for yarn ready made up in packages for exportation are—

	s.	d.	
For 30's twist or warp	1	6¼	per lb.
32's ,,	1	7	,,
36's ,,	1	8¼	,,
38's ,,	1	9¼	,,
40's ,,	1	10	,,

There is a great difference in the wages paid to spinners, according to the size of the mule, as will be more fully explained in Book IV. The general and most approved number of spindles in mules for spinning yarns from 32's to 40's is from 400 to 500; and the price paid to the spinner is 3¼*d.* per 100 hanks.

The cost of the above machines, of the best construction, at Manchester, is at present:

	£.	s.
The conical willow	70	0
The blowing machine	70	0
The lap machine	70	0
Carding engine, unclothed	42	0
Clothing (furniture) of ditto	24	0
Drawing frame	37	10

	£.	s.	d.	
Bobbin and fly frame (coarse) . . .	2	6	0	per spindle.
Ditto (fine) . . .	1	11	10	,,
Hand mule	0	4	9	,,
Self-actors, about	0	8	0	,,
Throstles	0	10	6	,,

The warp of a piece, thirty-six yards in length, of twenty-seven inch wide calico, for printing, made from 36's, will take about four pounds four ounces of yarn, and eight or nine ounces of flour for dressing it.

In a great fustian factory at Manchester, each girl weaves at the power-looms fifty pounds of cloth per week; in another factory of calicoes, nearly the same weight; in a third of finer goods, thirty-five pounds.

Mr. Fairbairn has very recently erected a spinning and weaving factory, upon the most improved plan, for Messrs. Bailey, of Stayley Bridge, of which the following is the estimated cost:—

	£.
Buildings for containing the machinery	30,000
Engine-house, boiler-house, and gas-house . . .	3,000
Two steam-engines, of 110 horse power each, with mill geering	8,800
Steam pipes for heating the mill, and gas pipes with gas apparatus	2,400
40,000 mule spindles	11,500
Preparation machines, including cotton cleaning and opening	12,000
1,280 power-looms, with appurtenances	18,000
Contingencies	2,300
Total cost of the factory . . .	£88,000

Or, probably, £90,000.

An additional weaving shed is proposed, which will increase the looms to 1,480, and the outlay to £100,000. The power of these united steam-engines is conveyed

from the rim of the fly wheel, which is a new plan of geering mills,—one already tried by Mr. Fairbairn in another mill, and found to exceed his most sanguine expectations of steady impulsion. Thus the fly wheel becomes, in fact, the great spur wheel, so as to serve the double purpose of regulating the motion of the engines, and transmitting the power to the mill shafts.

List of PATENTS *for Improvements in Cotton-Spinning, &c., from January* 1800, *to March* 1836, *both inclusive.*

Name.	Date.	
Ward, J. S.	Dec. 30, 1800	Doubling
Wood, J.	June 14, 1803	Spinning and reeling
Johnson, Thomas . .	Feb. 28, 1803	Preparing; dressing cotton-ways
Wood, J.	Jan. 10, 1804	Spinning
Heppenstall, John . .	June 2, 1804	Spinning and twisting
Johnson, Thomas . .	June 2, 1804	Dressing
Huddart, Joseph . .	Sept. 21, 1804	Manufacturing and spinning
Margrave, Thomas . .	Dec. 19, 1804	Throwing; spinning; doubling and twisting
Dundonald, Earl of . .	Nov. 19, 1805	Spinning
Clark and Bugby . .	June 19, 1806	Ditto
Robertson, Matthew . .	Oct. 30, 1806	Combining machinery
Thomson, Archibald .	Feb. 20, 1807	Spinning
Ditto ditto . .	April 2, 1807	Ditto
Williams, Samuel . .	April 8, 1807	Ditto
Laybourn and Milbourn	Dec. 9, 1807	Roving
Bradbury, John Leigh .	Dec. 24, 1807	Spinning
Dumbell, John	Aug. 25, 1808	Flax-spinning
Harkey, Musgrave and Farmery	Nov. 8, 1808	Roving; slubbing and spinning; twisting & doubling
Thomson, Archibald .	Feb. 7, 1809	Spinning
Stead, John	Feb. 9, 1809	Making cards for carding
Rutt, Tretton, and Webb	Nov. 21, 1809	Ditto
Varley, Richard . . .	July 7, 1810	Roving; spinning; doubling and twisting
Rutt, Tretton, and Webb	Oct. 8, 1810	Making cards
Cranfield, Thomas . .	May 7, 1811	Spinning and roving
Dyer, J. C.	Oct. 30, 1811	Cards
Dyer, Joseph C. . . .	Nov. 1, 1813	Spinning hemp
Rayner, Joseph . . .	Jan. 1, 1813	Roving and spinning
Courtauld, George . .	Aug. 4, 1814	Spindle
Dyer, J. C.	Dec. 15, 1814	Cards
Wood, John	Feb. 4, 1815	Preparing and spinning
Palmer, William . .	April 4, 1815	Twisting
Wood and Wordsworth .	March 2, 1816	Spinning
Bradbury, John Leigh .	March 9, 1816	Ditto

Name.	Date.	
Welch, John . . .	Aug. 3, 1816	Making rollers
Simpson, Wm. Henry .	July 10, 1817	Spinning
Hall, Samuel . . .	Nov. 3, 1817	Singeing
Whitham, George . .	April 8, 1818	Grinding & dressing spindles
Homfray, Thomas . .	May 28, 1818	Bobbins
Eaton, William . . .	June 18, 1818	Roving; spinning
Main, Joseph . . .	Jan. 15, 1820	Preparing; spinning
White, James . . .	July 11, 1820	Ditto
Chell, P.	Feb. 18, 1823	Drawing; roving; spinning
Crighton, Wm. . . .	Mar. 18, 1823	Carding cylinders
Hall, Samuel . . .	April 18, 1823	Singeing
Taylor, Joseph . . .	April 29, 1823	Spinning; doubling; throwing
Green, John . . .	June 26, 1823	Roving; spinning; twisting
Leach, Thomas . . .	Aug. 18, 1823	Spinning and doubling
Donkin, Bryan . . .	Sept. 11, 1823	Singeing
Gimson, T. F. . . .	Nov. 6, 1823	Twisting; doubling
Buchanan, Archibald .	Dec. 4, 1823	Carding
Boot, Jarvis . . .	Dec. 13, 1823	Singeing
Heathcoat, John . .	Mar. 20, 1824	Spinning
Bradbury, John Leigh .	July 3, 1824	Twisting; spinning; throwing
Jefferies & Drakeford .	July 29, 1824	Swift
Price, John	Aug. 5, 1824	Spinning
Chell, P.	Oct. 14, 1824	Drawing; roving; spinning
Bodmer, John George .	Oct. 14, 1824	Cleaning; carding; drawing; roving; spinning
Hirst, William . . .	Jan. 11, 1825	Slubbing; spinning
Andrew, Tarlton, and Shepley	Jan. 11, 1825	Throstle
Booth and Bailey . .	Jan. 13, 1825	Spinning; doubling; throwing
Badnall, Richard . .	Feb. 10, 1825	Winding; doubling; spinning
Roberts, Richard . .	Mar. 29, 1825	Spinning
De Jongh, Maurice . .	Mar. 29, 1825	Preparing; spinning
Smith, John Frederick .	June 21, 1825	Drawing; roving; spinning; doubling
Hirst, Wm. and Henry	July 16, 1825	Scribbling; carding
Hurst and Carter . .	July 16, 1825	Mules and billies
Dyer, J. C.	July 16, 1825	Winding
Brooke and Hardgrave .	July 26, 1825	Scribbling; carding
Kay, James	July 26, 1825	Spinning; preparing
Lamb and Suttill . .	Nov. 17, 1825	Preparing; drawing; roving; spinning
Edmonds, Ezekiel . .	Dec. 3, 1825	Scribbling; carding

Name.	Date.	
Dyer, J. C.	Dec. 9, 1825	Wire cards
Houldsworth, Henry .	Jan. 16, 1826	Roving
Smith, John Frederick .	Jan. 19, 1826	Drawing; roving; spinning
Goulding, John . . .	May 2, 1826	Carding; slubbing; roving; spinning
Molineux, Francis . .	May 23, 1826	Spinning; twisting; roving
Bayliffe, Edward . .	July 14, 1826	Drawing; roving; spinning
De Jongh, Maurice . .	Dec. 18, 1826	Roving; spinning; twisting
Heisch, Philip . . .	Feb. 20, 1827	Spinning
Whitaker, James . .	April 24, 1827	Carding; slubbing; spinning
Daniell, J. C.	June 8, 1827	Wire cards
Dexter, Lambert . .	June 16, 1827	Spinning
Church, William . .	July 13, 1827	Ditto
De Jongh	Dec. 4, 1827	Ditto; doubling; twisting; roving
Ford, John	May 13, 1828	Carding; roving; spinning
Sharp, William . . .	Aug. 19, 1828	Spinning; roving
Rhodes, Joseph . . .	Sept. 18, 1828	Ditto; twisting
Lee, George William .	May 2, 1829	Spinning
Brooks, Charles . .	June 4, 1829	Ditto
Hutchison, John . .	July 30, 1829	Ditto
Lane, William . . .	Aug. 5, 1830	Roving frames
Molineux and Bundy .	Sept. 21, 1830	Roving; spinning; twisting
Sands, Thomas . . .	Nov. 18, 1830	Spinning
Needham, William . .	Dec. 13, 1830	Spinning; doubling; twisting
Wood, Charles . . .	Mar. 11, 1831	Ditto
Potter, John and James	Mar. 21, 1831	Ditto; twisting
Knowles, Thomas . .	May 23, 1831	Mules, self-acting
Lambert, Samuel . .	June 2, 1831	Throstle; spindles
Milne, John	July 13, 1831	Roving
Lang, James	Sept. 24, 1831	Spreading; drawing; roving; spinning
Bates, Joshua	Oct. 27, 1831	Roving; twisting; spinning
Selden, David	Nov. 22, 1831	Carding; slubbing
Gore, Henry	Dec. 22, 1831	Throstle; frames
Jellicorse, John . .	Jan. 28, 1832	Spinning
Shaukland, Alex. Beattie	April 13, 1832	Ditto
Montgomery, Robert .	April 26, 1832	Ditto
Bolton, Hugh	June 5, 1832	Carding
Wordsworth, Joshua .	July 26, 1832	Drawing; roving; spinning
Jones, James	May 25, 1833	Roving; spinning; doubling
Newton, William . .	July 11, 1833	Roving
Howard, John . . .	Sept. 21, 1833	Ditto
Robertson, John . .	Sept. 21, 1833	Ditto; spinning
Travis, John, jun. . .	Nov. 1, 1833	Spinning

Name.	Date.	
Ewart, Peter	Nov. 9, 1833	Mule-spinning
Dobson, Sutcliff, and Threlfall	Feb. 6, 1834	Roving; spinning
Smith, James	Feb. 20, 1834	Preparing; spinning
Ditto	Feb. 27, 1834	Carding
Walton, James	Mar. 27, 1834	Cards
Simpson, Richard	June 3, 1834	Roving; slubbing
Bridson, Thomas R.	June 10, 1834	Drying cotton
Wilson, Charles	June 17, 1834	Spinning
Higgins, William	July 7, 1834	Roving
Wright, Peter	July 17, 1834	Spinning; twisting
Slater, James	Aug. 23, 1834	Bleaching
Sharp and Roberts	Oct. 8, 1834	Spinning and doubling
M'Gregor, Malcolm	Oct. 20, 1834	Slubbing; roving; spinning
Jones, James	Oct. 20, 1834	Roving; spinning; doubling
De Bergue, Charles	Nov. 15, 1834	Spinning; twisting
Fairbairn, Peter	Dec. 23, 1834	Preparing; slivering; roving
Whitworth, Joseph	April 14, 1835	Spinning; doubling
Bodmer, John George	May 27, 1835	Preparing; roving; spinning
Kean, James	July 3, 1835	Throstle; flyer
Dyer and Smith	July 17, 1835	Winding
Faulker, Samuel	Aug. 6, 1835	Carding
Barber, Richard	Oct. 22, 1835	Reels
Horsfall and Kenyon	[illegible] 9, 1835	Carding
Houldsworth, John	Dec. 9, 1835	Drawing; slubbing
Hyde, John	Dec. 31, 1835	Carding
Champion	Jan. 6, 1836	Spinning; twisting; doubling
Ramsbottom	Jan. 6, 1836	Roving; spinning; doubling
Ashworth & Greenough	Feb. 5, 1836	Preparing; spinning

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NOTES.

Note A.—p. 9.

The commentaries of schoolmen upon the notices of natural history and the arts which occur in the classics, are often no less amusing from their ignorance than their dogmatism. Virgil has in particular suffered severely at their hands, notwithstanding their pretended reverence for his learning. He is universally allowed to be the most exact of ancient authors in describing the productions of nature, and in selecting epithets appropriate to their qualities; for he was a proficient in all the philosophy of his age. Addison says, "We receive more strong and lively ideas of things from his words than we could have done from the objects themselves." His language is so graphic as to lead another critic to say, "that he found out living words." Of all literary compositions, ancient or modern, his Georgics are reckoned to be the most highly finished, displaying a vividness of conception, a regularity of thought, a felicity of diction, an accuracy and extent of information, which could have resulted only from the deepest study, animated by the brightest genius. Virgil was peculiarly conversant with the appearances, properties, and geography of the animal and vegetable tribes. His description of the cotton plant in the couplet quoted in the text is no less picturesque than philosophical, including also two of its most remarkable localities,—Ethiopia, and the country of the Seres, or Bochyra. How strangely has the *learned* Warton travestied the original in the following doggrel rhyme: —

> "From Æthiop's woods, where *woolly leaves* increase,
> How Syrians comb the vegetable fleece!"

Woolly leaves, and the Syrians combing the woods of Ethiopia! What a pity he had not gone to school with Mrs. Malaprop and become acquainted with the *contagious* places. It was the Seres of whom Virgil speaks, an Indian people far enough from Syria, who were famous then, as they are now, for the growth and manufacture of cotton.

Martyn, in his learned edition of Virgil, Oxford, 1829, thus comments upon the line "Velleraque ut foliis depectant tenuia Seres."

"The Seres were a people of India who furnished the other parts of the world with silk; the ancients were generally ignorant of the manner in which it was spun by the silkworm, and imagined that it was a sort of down gathered from the trees."

There is no evidence that the Seres supplied the world with silk, though there is, that they supplied it with muslin robes. But who that ever saw a silk cocoon enclosed in its entangled net-work of floss, would think of *combing it* out, or would charge Virgil with the folly of applying the word *depectant* to it; whereas to the fleece of cotton-wool, waving tress-like from its opened pods, the term *depectant* is most appropriate. The phrase, *tenuia vellera*, or delicate fleece, also corresponds to the character of cotton-wool as known to the Romans, and as described by Pliny, but is quite inapplicable to the silkworms' coils. The poet and the naturalist probably derived their knowledge of cotton plants from the same source—ambassadors and other distinguished travellers who came to Rome from Eastern Asia.

Note B.—p. 189.

For the following important document I am indebted to James Cosmo Melville, Esq., the accomplished Secretary of the East India Company:—

Statement of the Quantity of Cotton Yarn imported from India in each Year from 1700 *to* 1760.

1700	The General Books for these years are missing.		lbs.
1701		1731	20,496
1702		1732	46,405
1703	114,100 lbs.	1733	70,976
1704	72,938	1734	5,924
1705	39,155	1735	91,394
1706	48,120	1736	40,274
1707	219,879	1737	2,083
1708	The General Books for these years do not particularize the goods imported; the Subsidiary Books, from which the information could be supplied, are missing.	1738	3,024
1709		1739	8,445
1710		1740	3,339
1711		1741	20,055
1712		1742	11,366
1713	135,546 lbs.	1743	9,904
1714	12,768	1744	14,593
1715	nil	1745	nil
1716	nil	1746	nil
1717	nil	1747	nil
1718	37,714	1748	nil
1719	nil	1749	nil
1720	21,350	1750	14,112
1721	50,624	1751	4,704
1722	10,800	1752	336
1723	24,025	1753	nil
1724	21,588	1754	nil
1725	5,809	1755	37,632
1726	54,300	1756	6,061
1727	27,254	1757	4,357
1728	11,424	1758	12,869
1729	18,816	1759	4,390
1730	32,351	1760	2,814

East India House, March 23, 1836.

The above Table shows that during the early part of the last century the cotton yarn imported from Hindostan bore a very considerable relation to the whole cotton wool imported into Great Britain. Thus in 1710 the total importation of cotton wool was 715,008 lbs. while in 1707 that of Indian yarn was 219,879 lbs, and in 1713, 135,546 lbs. The quantities of yarn imported by the Company seem to have suffered extraordinary vicis-

situdes ill accordant with the regular course of the home manufactures into which they entered. It is reasonable, therefore, to infer that there must have been in the intervals very large importations of these yarns through the contraband traders, who are known to have supplied the European markets, to a great extent, with the highly prized and then inimitable muslins and calicoes of the Eastern world.

Average Price of Cotton Yarn per lb., from 1700 *to* 1760, *as sold by the East India Company.*

	s.	d.		s.	d.
1700 to 1705 .	.	.	No particulars of these years can be given.		
1706 . . .	2	2¾			
1707 . . .	1	11¼			
1708 to 1728	.	.	Ditto, ditto.		
1729 . . .	1	10½			
1730 . . .	2	4¾			
1731 . . .	2	2½			
1732 . . .	2	3¾			
1733 . . .	2	2¼			
1734 . . .	2	4½			
1735 . . .	3	0			
1736 . . .	2	3¼			
1737 . . .	3	5½	Some few bales sold at	8	1
1738 . . .	3	9¼	Ditto	8	8
1739 . . .	5	5½	Ditto	21	2
1740 . . .	.	.	None sold.		
1741 . . .	4	5½	Some few bales sold at	17	2
1742 . . .	5	6¼	Ditto	14	7
1743 . . .	7	2¼	Ditto	12	8
1744 . . .	4	7½	Ditto	8	1
1745 . . .	6	0½			
1746 to 1748 .	.	.	None sold.		
1749 . . .	4	11¾			
1750 . . .	3	5½			
1751 . . .	.	.	Ditto.		
1752 . . .	4	5½			
1753 . . .	6	8¼			
1754 . . .	.	.	Ditto.		
1755 . . .	3	10			
1756 . . .	4	0¼			
[illegible] . . .	2	9¾	Some few bales sold at	15	0
. . .	2	11½	Ditto	15	0
. . .	4	8	Ditto	14	0
. . .	.	.	None sold.		

For the above Table I am also indebted to the courtesy of James C. Melville, Esq. The duty, as would appear from the following letter of J. D. Hume, Esq., Secretary of the Board of Trade, was about 4½*d.* per lb.

15, *Russell Square*, April 3, 1836.

Dear Sir,—I have looked back to some old Custom-house books, and see that in 1757 the duties on cotton yarn were,—East Indian, the pound 4½*d.* and a very small fraction, and all other yarn a fraction under 3*d.* the pound. The fractions arose from the gross duty being formed of various rates, and also various per-centages, additions upon some of these rates,—so that scarcely any gross duty on any article conformed to our coinage.

As the duty above given is quoted from a book published in 1757, I cannot say how long it had stood at that amount; and considering that, previous to Mr. Pitt's first consolidation in 1787, the sums payable were always composed of numerous duties, added from time to time to some ancient first duty, it would be hardly possible at this day to trace them back so as to find how they stood at still earlier periods. *I should have thought that the East India House must have had records of their imports and payments, so as to have cleared up the question by reference to actual transactions.* I am, dear sir,

Yours very truly,

Dr. Ure. J. D. Hume.

APPENDIX.

EXPORTATIONS OF COTTON MANUFACTURES AND COTTON TWIST, FROM THE UNITED KINGDOM.

COUNTRIES.	1827.					1828.				
	Entered by the Yard.		Hosiery, Lace, and Small Wares.	Cotton Twist and Yarn.		Entered by the Yard.		Hosiery, Lace, and Small Wares.	Cotton Twist and Yarn.	
	Quantities.	Declared Value.	Declared Value	Quantities.	Declared Value	Quantities.	Declared Value.	Declared Value.	Quantities.	Declared Value.
	Yards.	£.	£	lbs.	£.	Yards.	£.	£.	lbs.	£.
Russia	4,258,508	155,932	23,704	12,070,675	933,204	2,502,267	93,454	24,210	14,882,644	958,242
Sweden	65,569	2,620	820	250,290	18,365	21,864	1,060	310	321,294	20,449
Norway	214,400	8,386	1,200	9,294	599	364,505	14,546	1,799	14,865	847
Denmark	270,338	8,238	505	265,824	19,064	248,416	7,686	351	164,207	10,945
Prussia	20,543	1,006	626	55,779	4,888	9,100	357	175	48,360	4,055
Germany	43,675,688	1,539,826	205,495	17,028,354	1,351,508	39,501,640	1,325,828	277,455	17,233,115	1,250,791
Holland. Belgium	13,734,445	550,587	281,347	6,295,493	580,937	13,277,621	506,518	275,406	7,056,293	621,933
France	365,100	16,055	7,906	15,722	1,580	79,196	5,945	13,433	32,116	3,680
Portugal, Proper	25,472,135	733,546	16,874	193,456	16,253	18,309,401	485,392	10,597	130,007	10,659
,, Azores	385,583	11,604	185	. .	. .	424,980	12,073	247	1,424	80
,, Madeira	388,942	12,542	589	13	2	386,253	12,398	1,212		
Spain and the Balearic Islands	340,516	14,546	1,246	21,365	1,591	327,662	13,138	2,549	5,907	616
,, Canaries	638,571	25,297	758	1,048	108	685,764	22,188	711	1,632	81
Gibraltar	17,202,891	593,131	19,233	105,262	8,866	18,507,940	638,965	22,038	53,832	5,229
Italy and the Italian Islands	28,113,538	905,330	27,641	4,457,476	267,920	32,822,686	993,652	36,488	5,153,295	263,554
Malta	3,275,227	100,297	1,344	250,794	13,267	4,466,526	128,190	2,021	417,964	22,126
Ionian Islands	105,894	3,757	167	11,952	990	106,855	3,731	202	21,320	1,517
Turkey and Continental Greece (exclusive of the Morea) Morea & Greek Islands	11,560,172	364,108	570	647,094	39,694	4,719,481	129,381	832	156,860	10,834
Egypt (Ports on the Mediterranean)	1,966,654	48,715	50	. .	. .	959,580	23,668			

Tripoli, Barbary, and Morocco	183,395	4,666	. .	1,500	70	406,712	10,327			
Western Coast of Africa	1,026,584	41,870	208	50	19	1,536,861	57,376	189	50	5
Cape of Good Hope	1,748,556	60,838	7,105	2,182	289	2,353,346	74,929	4,780	3,716	375
Cape Verd Islands	. .	. .	. .	. .	. .	74,318	2,046	50		
St. Helena	44,932	1,824	157	112	12	42,412	1,594	130		
Isle of Bourbon	. .	. .	. .	. .	. .	1,000	40			
Mauritius	1,696,516	67,435	5,482	. .	. .	1,477,886	57,253	5,337		
East India Company's Territories & Ceylon	36,167,952	1,355,158	40,993	3,063,556	273,990	37,566,836	1,394,681	43,344	4,549,919	390,344
China	1,581,353	66,345	935	300	25					
Sumatra and Java	2,342,207	87,987	1,697	. .	. .	4,680,371	153,238	1,138	37,836	2,790
Philippine Islands	887,244	36,902	2,791							
New South Wales, Van Diemen's Land, and Swan River	1,105,957	41,309	4,900	3,813	370	1,242,285	43,548	8,190	5,704	445
New Zealand and South Sea Islands	. .	. .	. .	. .	. .	3,672	158			
Ports of Siam	. .	. .	. .	. .	. .	. .	. .	. .	.	. .
British North American Colonies	6,616,812	224,467	13,875	35,568	2,200	9,202,255	304,328	18,679	66,520	3,518
British West Indies	26,730,096	888,661	51,202	7,680	744	21,096,050	689,291	41,038	5,327	521
Hayti	4,288,244	145,085	2,763	. .	. .	5,009,333	167,731	1,437		
Cuba and other Foreign West Indies	9,779,788	360,300	14,801	. .	. .	8,004,786	292,214	11,717	370	180
United States of America	52,856,809	2,257,955	269,075	8,914	1,547	36,200,427	1,612,466	185,021	100,285	6,516
Mexico	13,687,021	507,336	28,235	9,460	1,068	5,331,635	227,514	9,210	150	41
Guatemala	9,174	400	150	. .	. .	109,083	4,199	340	4,000	200
Columbia	3,987,030	139,322	6,472	110	40	5,081,948	163,663	10,496		
Brazil	37,195,322	1,119,344	39,600	8,361	2,145	63,098,012	1,967,643	62,386	13,340	2,072
States of the Rio de la Plata	2,076,897	69,527	6,159	25,208	761	4,903,450	160,576	12,574		
Chili	5,825,700	203,722	27,349	13,846	1,509	13,206,412	461,680	29,483	14,652	1,560
Peru	2,917,056	114,866	14,977	14,040	1,501	4,129,112	166,808	29,810	5,160	606
Isles of Guernsey, Jersey, Alderney, & Man	683,445	57,148	15,366	3,583	459	848,492	51,776	20,379	4,287	601
Total	365,492,804	12,948,035	1,144,552	44,878,774	3,545,578	363,328,431	12,483,249	1,165,763	50,505,751	3,595,405

EXPORTATIONS OF COTTON MANUFACTURES AND COTTON TWIST (*continued*).

COUNTRIES.	1829.					1830.				
	Entered by the Yard.		Hosiery, Lace, and Small Wares.	Cotton Twist and Yarn.		Entered by the Yard.		Hosiery, Lace, and Small Wares.	Cotton Twist and Yarn.	
	Quantities.	Declared Value.	Declared Value.	Quantities.	Declared Value.	Quantities.	Declared Value.	Declared Value.	Quantities.	Declared Value.
	Yards.	£.	£.	lbs.	£.	Yards.	£.	£.	lbs.	£.
Russia	2,453,676	94,872	23,146	17,921,369	1,062,225	4,194,962	142,463	13,512	18,555,753	1,087,662
Sweden	12,986	538	205	320,660	18,929	8,868	217	88	322,850	17,702
Norway	574,650	20,543	2,296	16,242	890	601,322	18,003	1,738	17,635	1,010
Denmark	352,097	8,439	429	85,161	5,222	399,118	8,539	177	96,718	5,467
Prussia	17,725	517	405	42,878	3,792	246	13	39	41,040	3,370
Germany	41,019,652	1,137,532	279,355	24,055,423	1,585,979	43,816,980	1,174,620	303,950	21,730,661	1,449,521
Holland, Belgium	11,399,792	443,705	214,681	7,878,249	673,714	10,533,793	402,363	244,326	7,254,258	612,925
France	509,030	15,462	3,335	19,500	1,486	139,465	7,055	2,946	5,582	391
Portugal, Proper	24,701,993	631,125	12,385	159,567	14,083	21,372,740	592,759	12,471	221,383	14,024
,, Azores	466,226	13,108	521	1,400	63	397,930	10,596	365	3,012	252
,, Madeira	502,631	14,602	616	12	1	448,994	13,348	572		
Spain and the Balearic Islands	11,018,689	326,708	12,978	17,620	1,475	6,146,471	190,836	10,318	7,590	694
,, Canaries	712,424	21,767	1,206	3,054	224	597,977	17,973	959	700	32
Gibraltar	10,242,089	310,723	10,052	21,873	2,194	4,758,662	139,632	5,772	14,835	1,044
Italy and the Italian Islands	36,808,440	1,081,461	44,849	6,355,154	317,580	53,286,586	1,706,324	52,601	8,371,944	433,754
Malta	4,628,367	105,995	1,869	438,640	21,528	2,899,773	73,044	1,295	381,430	19,296
Ionian Islands	96,028	3,141	66	15,100	859	222,555	6,381	580	45,440	2,700
Turkey and Continental Greece (exclusive of the Morea)	15,536,350	392,725	1,431	662,538	39,918	33,458,077	858,132	3,627	1,528,271	86,148
Morea & Greek Islands	. .	. .	. .	. .	. .	350,265	7,452	. .	20,700	1,261
Egypt (Ports on the Mediterranean)	1,875,161	43,410	. .	28	2	2,953,343	71,404	190	164,980	8,946

Tripoli, Barbary, and Morocco	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
Western Coast of Africa	1,910,940	70,104	115	. .	. .	2,506,266	96,042	229	370	54
Cape of Good Hope	2,520,127	75,310	6,368	3,331	339	3,973,967	115,487	6,758	19,860	1,296
Cape Verd Islands	. .	. .				21,716	534			
St. Helena	31,597	1,048	173	1	1	33,499	1,129	391	38	1
Isle of Bourbon	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
Mauritius	1,658,937	53,150	7,845	. .	. .	1,875,762	64,914	3,031	56	7
East India Company's Territories and Ceylon China	39,733,698	1,267,216	28,395	3,185,639	210,182	52,179,844	1,549,730	12,844	4,941,995	333,295
Sumatra and Java	3,502,163	121,036	447	. .	. .	2,792,143	102,512	4,153	19,680	2,040
Philippine Islands	93,279	4,448	. .	. .	. .	1,926,095	62,275	1,315	19,300	1,440
New South Wales, Van Diemen's Land, and Swan River	476,065	19,067	3,498	4,805	479	1,187,640	39,352	6,325	11,999	848
New Zealand and South Sea Islands	2,608	80	. .	. .	. .	3,037	90			
Ports of Siam	. .	. .	. .	. .	. .	204,701	7,644	100		
British North American Colonies	8,671,237	261,546	16,191	84,760	4,477	11,434,448	349,256	96,341	213,394	8,803
British West Indies	33,319,295	997,408	52,872	1,230	195	18,955,323	608,099	37,669	6,909	698
Hayti	6,654,839	207,630	3,965	616	144	7,216,267	209,452	4,293		
Cuba and other Foreign West Indies	11,447,514	395,288	11,906	50	5	9,016,085	318,744	9,315		
United States of America	32,552,062	1,346,023	155,334	30,192	1,928	49,351,574	2,055,658	249,507	48,980	3,598
Mexico	6,007,047	204,677	9,441	97,320	6,660	17,535,351	631,003	29,543	560,090	32,086
Guatemala	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
Columbia	4,277,904	132,526	5,918	. .	. .	4,165,789	141,947	4,696	1,740	80
Brazil	50,077,739	1,437,963	50,369	5,300	679	46,204,428	1,369,041	47,196	5,560	650
States of the Rio de la Plata	15,429,383	495,381	24,657	5,460	506	10,805,990	324,305	20,005	5,831	587
Chili	16,972,286	570,863	22,508	2,735	327	10,155,279	363,435	9,175		
Peru	3,465,460	143,798	15,689	800	48	5,365,828	216,521	17,129		
Isles of Guernsey, Jersey, Alderney, & Man	785,510	55,312	17,269	4,554	741	1,079,339	51,446	29,682	4,828	2,128
Total	402,517,196	12,516,247	1,041,885	61,441,251	3,976,874	444,578,498	14,119,770	1,175,153	64,645,342	4,133,741

EXPORTATIONS OF COTTON MANUFACTURES AND COTTON TWIST (*continued*).

COUNTRIES.	1831. Entered by the Yard. Quantities.	1831. Entered by the Yard. Declared Value.	1831. Hosiery, Lace, and Small Wares. Declared Value.	1831. Cotton Twist and Yarn. Quantities	1831. Cotton Twist and Yarn. Declared Value.	1832. Entered by the Yard. Quantities.	1832. Entered by the Yard. Declared Value.	1832. Hosiery, Lace, and Small Wares. Declared Value.	1832. Cotton Twist and Yarn. Quantities.	1832. Cotton Twist and Yarn. Declared Value.
	Yards.	£.	£.	lbs.	£.	Yards.	£.	£.	lbs.	£.
Russia	1,960,634	68,412	7,232	13,959,666	790,371	3,024,369	110,456	12,721	19,587,781	1,136,787
Sweden	18,280	615	216	708,510	34,885	35,165	1,306	421	743,747	28,856
Norway	434,744	13,704	1,829	34,440	1,553	146,573	3,924	1,117	13,035	610
Denmark	312,461	6,213	912	118,316	5,716	295,658	5,702	360	71,680	2,320
Prussia	1,456	80	20	19,448	1,556	333	24	33	26,241	2,001
Germany	41,520,616	940,441	205,527	20,435,442	1,195,718	51,479,478	1,162,875	336,500	29,959,427	1,796,987
Holland, Belgium	13,285,524	333,127	214,123	9,091,238	794,536	22,432,994	596,957	250,086	10,345,649	890,423
France	946,660	35,557	13,613	2,616	1,127	826,487	29,127	35,869	8,437	1,314
Portugal, Proper	23,377,245	373,916	13,454	281,096	17,534	13,461,688	286,386	10,906	37,230	2,899
,, Azores	780,099	17,126	383	3,240	149	1,028,861	20,032	712	28,603	1,228
,, Madeira	569,794	14,577	677	. .	. .	355,166	7,955	582	54	5
Spain and the Balearic Islands	4,756,652	129,778	9,503	36,170	3,147	2,940,969	72,076	2,877	10,430	771
,, Canaries	631,079	15,646	515	2,500	131	377,938	9,497	338	1,200	56
Gibraltar	9,909,009	238,732	6,158	39,196	3,178	11,888,333	281,024	13,241	95,922	7,040
Italy and the Italian Islands	38,164,564	1,035,748	44,172	8,444,518	438,834	47,695,264	1,115,839	41,874	7,641,928	381,948
Malta	1,967,953	49,504	1,403	312,740	13,469	1,328,070	35,084	970	205,450	10,382
Ionian Islands	216,159	5,210	615	62,450	3,643	785,007	16,261	682	55,665	3,048
Turkey and Continental Greece (exclusive of the Morea)	24,565,580	585,473	3,335	1,735,760	99,015	24,206,969	632,394	1,046	1,361,913	69,440
Morea & Greek Islands	344,893	6,540	. .	11,000	600	116,748	4,631	. .	1,900	50
Egypt (Ports on the Mediterranean)	2,354,628	56,088	26	93,600	6,000	2,559,930	55,950	66	199,980	19,319

Tripoli, Barbary, and Morocco	7,810	123	. .	. .	. .	7,090	205	2		
Western Coast of Africa	2,384,000	75,058	446	280	34	3,878,034	97,542	364	1,070	169
Cape of Good Hope .	2,904,106	83,612	3,807	193	19	3,464,586	93,710	6,065	1,355	196
Cape Verd Islands .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
St. Helena	73,371	2,173	254	. .	. .	53,368	1,434	118	169	12
Isle of Bourbon . .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
Mauritius	2,432,894	65,185	3,400	. .	. .	2,365,555	68,973	3,925	2,500	196
East India Company's Territories and Ceylon China	43,385,852	1,182,574	13,972	6,624,823	467,861	51,833,913	1,311,773	18,697	4,316,645	302,379
Sumatra and Java . .	5,915,088	194,889	1,730	312,000	22,653	2,671,698	85,046	503	102,500	6,920
Philippine Islands .	1,432,583	33,639	13	18,800	1,796	2,106,177	72,666			
New South Wales, Van Diemen's Land, and Swan River . . .	1,905,428	61,567	8,380	7,233	330	1,744,606	58,836	7,905	9,411	509
New Zealand and South Sea Islands . . .	5,014	135	. .	. .	. .	3,200	100	45		
Ports of Siam . . .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
British North American Colonies . .	15,618,106	413,737	25,536	307,997	10,376	16,166,875	411,230	30,606	260,699	8,633
British West Indies .	21,975,459	606,923	31,568	14,416	835	25,631,940	628,920	20,040	4,973	485
Hayti	6,828,576	178,743	4,731	320	30	11,563,084	321,224	13,767	252	20
Cuba and other Foreign West Indies . . .	11,569,441	364,547	11,329	200	10	15,802,809	373,839	10,590	500	50
United States of America	68,587,893	2,518,824	344,427	317,392	19,063	31,508,744	1,049,375	193,109	82,104	5,045
Mexico	12,150,426	471,208	23,712	784,215	37,972	3,425,301	101,062	5,608	467,323	29,537
Guatemala	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
Columbia	5,757,562	177,559	9,060	28,880	1,580	7,877,984	183,746	5,676	100	8
Brazil	26,271,527	681,461	20,540	2,740	334	60,577,822	1,280,061	33,028	11,460	1,676
States of the Rio de la Plata	6,242,134	176,874	9,743	800	30	17,256,838	391,591	33,344		
Chili	12,793,220	431,323	26,851	4,800	130	13,861,434	368,920	32,047	1,700	160
Peru	6,312,931	222,708	19,605	. .	.	3,468,734	113,724	16,918	640	80
Isles of Guernsey, Jersey, Alderney, & Man	1,013,852	44,364	35,755	4,405	755	789,711	39,053	22,245	8,880	1,841
Total . . .	421,385,303	12,163,513	1,118,672	63,821,440	8,975,019	461,045,503	11,500,630	1,175,003	75,667,150	4,722,759

EXPORTATIONS OF COTTON MANUFACTURES AND COTTON TWIST (*continued*).

COUNTRIES.	1833. Entered by the Yard. Quantities.	1833. Entered by the Yard. Declared Value.	1833. Hosiery, Lace, and Small Wares. Declared Value.	1833. Cotton Twist and Yarn. Quantities.	1833. Cotton Twist and Yarn. Declared Value.	1834. Entered by the Yard. Quantities.	1834. Entered by the Yard. Declared Value.	1834. Hosiery, Lace, and Small Wares. Declared Value.	1834. Cotton Twist and Yarn. Quantities.	1834. Cotton Twist and Yarn. Declared Value.
	Yards.	£.	£.	lbs.	£.	Yards.	£.	£.	lbs.	£.
Russia	2,656,397	98,649	9,036	19,311,877	1,164,996	1,779,836	66,546	4,212	16,241,363	1,037,533
Sweden	31,173	1,029	591	557,595	31,711	52,090	1,605	590	499,550	30,018
Norway	481,474	13,157	1,906	55,562	2,893	567,531	14,602	1,925	62,423	3,575
Denmark	299,875	6,053	779	16,814	1,092	326,520	6,362	227	23,650	1,317
Prussia	. .	. .	6	21,007	1,692	4,608	220	199	24,342	2,017
Germany	49,534,158	1,183,534	252,315	23,653,904	1,598,467	50,527,498	1,293,617	207,105	26,492,890	1,793,458
Holland	20,610,649	491,778	46,770	11,242,705	971,719	21,189,927	549,084	49,718	13,084,898	1,122,337
Belgium	3,122,579	128,457	251,648	103,558	11,829	4,180,466	155,921	170,012	65,514	8,009
France	1,544,075	46,247	36,320	98,193	10,212	2,317,607	60,774	67,385	101,908	22,527
Portugal, Proper	25,278,084	540,842	18,409	50,062	3,366	42,004,094	899,862	19,895	241,937	19,955
,, Azores	1,228,931	24,751	776	13,565	626	1,361,159	30,661	914	30,612	1,112
,, Madeira	621,687	12,619	686	56	4	573,181	12,284	442	89	7
Spain and the Balearic Islands	328,263	9,288	1,218	2,550	447	456,670	12,184	1,053	2,646	350
,, Canaries	637,583	15,602	853	625	52	748,669	18,765	581	850	60
Gibraltar	9,103,461	216,439	5,091	10,920	910	13,130,134	312,729	7,927	12,909	1,071
Italy and the Italian Islands	47,672,152	1,083,073	40,756	6,956,453	376,835	60,683,663	1,563,243	52,844	9,888,968	543,808
Malta	2,238,974	57,887	935	136,330	6,940	4,560,503	122,156	1,891	531,840	28,887
Ionian Islands	233,692	5,504	368	54,440	2,955	1,747,855	36,313	958	129,622	8,888
Turkey and Continental Greece (exclusive of the Morea)	30,237,127	750,604	2,089	1,767,731	90,052	28,621,490	828,245	3,546	1,989,851	109,735
Morea & Greek Islands	316,897	12,311	345	. .	. .	460,984	17,493	870	1,581	140
Egypt (Ports on the Mediterranean)	2,682,903	54,743	10	177,850	11,028	3,929,444	95,874	296	531,714	29,900

Tripoli, Barbary, and Morocco	1,465	80	140	. .	. .	590,362	9,992	793		
Western Coast of Africa	4,964,666	118,872	396	690	107	4,975,433	129,584	607	570	120
Cape of Good Hope .	4,536,727	115,567	9,882	1,164	80	4,006,311	100,328	9,527	2,370	174
Cape Verd Islands .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
St. Helena	87,579	2,018	328	. .	. .	110,372	3,124	321	86	2
Isle of Bourbon . .	. .	. .	. .	. .	. .	98,240	1,194	36		
Mauritius	794,562	22,582	3,524	. .	. .	2,496,345	70,453	6,671	340	34
East India Company's Territories and Ceylon	45,755,910	1,152,486	21,153	4,783,794	324,353	38,972,059	943,504	15,717	4,967,653	315,583
China						6,381,018	152,395	10,503	952,440	56,239
Sumatra and Java .	11,091,558	316,264	1,813	247,450	15,446	10,118,790	290,901	1,863	328,970	17,443
Philippine Islands .	2,812,719	87,807	455	7,600	570	1,794,438	54,053	1,146	20,300	1,115
New South Wales, Van Diemen's Land, and Swan River . . .	1,828,859	53,428	7,653	11,960	593	3,724,420	101,701	11,584	11,433	652
New Zealand and South Sea Islands . . .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
Ports of Siam . . .	. .	. .	. .	. .	. .	519,025	11,416	30	22,000	1,565
British North American Colonies . .	14,210,060	339,143	29,314	216,806	9,915	10,225,292	263,291	20,357	194,692	6,458
British West Indies .	27,507,930	661,340	43,166	8,640	590	30,246,315	728,756	40,584	5,584	455
Hayti	7,224,810	219,983	6,367	1,000	110	7,166,854	212,587	5,936	4,300	505
Cuba and other Foreign West Indies . . .	12,889,249	323,338	9,465	540	34	21,174,586	511,887	13,424	10	1
United States of America	45,141,989	1,385,957	340,835	112,575	6,255	45,630,862	1,394,057	277,652	107,443	6,693
Mexico	5,745,446	201,428	16,527	968,720	53,694	6,823,964	251,177	7,878	463,546	27,364
Guatemala	53,127	1,800	. .	11,600	765	870,001	23,797	111	23,155	1,775
Columbia	3,210,561	66,743	3,312	. .	. .	5,315,157	114,022	3,262	35,600	3,453
Brazil	68,903,398	1,607,735	59,848	11,434	1,073	65,424,332	1,427,029	58,555	57,730	3,795
States of the Rio de la Plata	12,731,734	280,292	23,311	300	26	20,942,118	449,831	33,313	9,258	446
Chili	20,191,482	490,805	28,846	4,220	430	23,474,954	606,054	20,814	5,689	860
Peru	6,819,029	195,496	12,400	1,000	90	4,504,492	127,828	8,760		
Isles of Guernsey, Jersey, Alderney, & Man	687,302	45,329	41,683	5,471	2,067	896,040	49,051	33,255	6,192	984
Total . . .	496,352,096	12,451,060	1,331,317	70,626,161	4,704,024	555,705,809	14,127,352	1,175,219	76,478,468	5,211,015

1835—Exportations of Cotton Manufactures; Declared Value £16,394,590
,, ,, Cotton Yarn 5,709,044

TABLES EXTRACTED FROM THE RETURNS TO THE LANCASHIRE FORMS OF INQUIRY BY MR. S. STANWAY.

COTTON MILLS.

LIST I.—(Comprehending 151 Mills from which Complete Returns were made.)

Table extracted from the Returns to the Tabular Forms issued at Manchester on the 17th and 20th May, and 20th June, 1833.

	Name of Firm.	Town or Place in or near which the Mills are situate.	Hours during which the Mill worked in the Month ending May 4, 1833.	Counts spun.*	Average Counts spun.	Number of Persons engaged in preparing and spinning Cotton.	Number of Persons engaged in Weaving.	Number of Persons engaged as Engineers, Mechanics, Roller Coverers, &c.†	Total Number employed.**	Total NET Earnings realized by the Total NUMBER of Persons given in the preceding Column during the Month ending 4th May 1833, and for working the Number of Hours given in the Third Column. £. s. d.	Average Weekly Net Earnings of each Individual, calculated for 69 hours. Pence.
1a	Birley and Kirk	Manchester	270	14 to 40	25	931	471	100	1,692	3,470 12 0½	127·26
1b	Ditto	Duckenfield	276	22 to 40	30	176	..	14			111·79
2	Ormrod and Hardcastle	Bolton	274	30 to 200	100	1,255	295	26	1,576	2,877 5 6½	110·34
3	M'Connell and Co.	Manchester	276	100 to 240	170	1,493	..	52	1,545	3,374 2 0	131·03
4a	E. and W. Bolling	Bolton	286	36 to 110	50	698	..	30	1,356	2,446 6 2	100·19
4b	Ditto	Ditto	286	38 to 70	43·42	140	..	1			98·77
4c	Ditto	Ditto	276	46 to 68	57	213	..	1			98·18
4d	Ditto	Ditto	286	40 to 130	85	273	..	..			126·36
5	T. Houldsworth, M.P.	Manchester	276	130 to 230	180	1,155	..	46	1,201	2,456 10 2	122·72
6	Joseph Horsefield	Hyde	276	38 to 40	39·02	475	705	3	1,183	2,520 16 3	127·85
7	Thomas Ashton	Ditto	272	12 to 40	18·96	386	762	1	1,149	2,888 3 11	153·3
8	T. Marsland, M.P.	Stockport	267	18 to 32	25	347	566	34	947	2,447 7 11¾	160·28

9	Taylor, Hindle, and Co. . . .	Bolton . . .	272	Mule Twist 80 Water ditto 17	..	860	40	24	924	1,569	6	9	103·40
10	Collinge and Lancashire . . .	Oldham. . .	276	34 to 55	41·66	338	444	71	853	2,096	3	6	147·44
11	A. and G Murray .	Manchester .	276	90 to 200	145	805	..	36	841	1,989	16	4	141·96
12	Stirling and Beckton	Ditto . . .	264	14 to 24	19	343	432	66	841	1,699	13	9½	126·77
13	Joseph Lane and Son	Stockport . .	280·5	34 to 38	36	305	542	26	873	1,995	9	4½	134·94
14	Jer. Lees and Sons .	Stayley Bridge .	276	28 to 33	34	308	485	3	796	1,774	17	4½	133·78
15	The Oxford Road Twist Company .	Manchester . .	276	17 to 36	23	306	427	41	774	1,717	19	4	133·17
16	William Smith .	Heaton Norris .	276	36 to 40	38	267	490	4	761	1,668	17	4½	131·57
17	Lambert, Hoole, and Co.	Manchester. .	276	. .	..	725	..	27	752	1,422	14	8½	113·51
18a	Samuel Ashton . .	Apethorn Mill .	288	37	37	134	237	1	727	1,813	12	2½	143·80
18b	Ditto	Woodley Mill .	300	20 to 38	25·83	128	226	1					137·33
19	T. R and T. Ogden .	Manchester .	276	150 to 220	176	709	..	3	712	1,483	9	11	125·01
20	James Guest . .	Ditto . . .	276	16 to 24	20	323	336	3	712	1,243	2	1	104·75
21	C. and T. Howard .	Hyde . . .	276	36 to 38*	37	224	403	21	648	1,396	3	0	129·27

* N. B.—This column indicates the quality of work done in each mill during the month ending May 4, 1833. Mills are roughly classed in the district as "fine spinning" and "coarse spinning" mills, and each confines itself in general to its own class of work. Coarse spinning ranges from No. 1 to No. 90, at Manchester, and fine spinning from No. 90 to No. 340, which is the highest number that has ever been reached, as I have been informed, with the present machinery. These different qualities are technically called "the counts spun" or the "numbers spun."

A hank of cotton yarn or twist always measures 840 yards. Therefore,

No. 1 signifies that *one* hank of cotton yarn or twist weighs *one* pound.

No. 40 ,, ,, *forty* hanks taken collectively weigh *one* pound.

No. 340 ,, ,, *three hundred and forty* hanks taken collectively weigh *one* pound.

Consequently the length of 16 ounces of cotton yarn of the fineness of No. 340 is 840×340, or 285,600 yards, or rather more than 162 miles. Cotton yarn and cotton twist are general terms for all spun cotton.

† The hands in this column are all, strictly, "mill hands," and though some of them are not engaged in the actual manipulation of cotton, yet all are correctly entitled to be called "operatives." Jobbers are included in this column, but all the persons comprehended in the answers to the 1st and 2d primary queries of the first form, and likewise managers, are rigidly excluded from it, and, of course, from the two preceding columns.

TABLE OF COTTON MILLS (*continued*).

	Name of Firm.	Town or Place in or near which the Mills are situate.	Hours during which the Mill worked in the Month ending May 4, 1833.	Counts spun.	Average Counts spun.	Number of Persons engaged in preparing and spinning Cotton.	Number of Persons engaged in Weaving.	Number of Persons engaged as Engineers, Mechanics, Roller Coverers, &c.	Total Number employed.	Total NET Earnings realized by the Total NUMBER of Persons given in the preceding Column during the Month ending 4th May 1833, and for working the Number of Hours given in the Third Column. £. s. d.	Average Weekly Net Earnings of each Individual, calculated for 69 Hours. Pence.
22a	Sampson, Lloyd, and Co.	Stockport	287	36 to 40	33	116	252	1	632	1,354 7 1	127·28
22b	Ditto	Ditto	276	36 to 40	38	57	54	..			149·09
22c	Ditto	Ditto	257	36 to 40	38	50	102	..			112·13
23	John Howard	Hyde	296	36 to 40	38	241	358	29	628	1,512 18 3½	134·77
24	James Kennedy	Manchester	272	70 & below and 170	90	594	..	5	599	957 12 10	97·33
25	Bayley and Brothers	Stayley Bridge	315	34 to 38	35·33	243	322	20	585	1,435 13 7½	129·01
26	Henry Sidebottom and Brothers	Houghton	270	12 to 40	36·78	245	331	1	577	1,310 11 8	136·28
27	Samuel Greg and Co.	Bury	273·5	12 to 36	24·14	217	326	14	557	1,009 1 7½	109·69
28	Hugh Beaver	Manchester	267	20 to 55	22·01	201	301	23	525	1,091 15 8½	128·98
29	H. and E. Ashworth	Bolton	271	50 to 100	..	515	..	2	517	986 10 9	116·60
30	Pooley and Son	Manchester	264	30 to 40	35	475	..	39	514	967 1 8	118·02
31	George Cheetham and Sons	Duckenfield	Above 18 300; Under 18 274	6 to 60	30	454	..	6	460	881 19 3	108·58
32	Jesse Howard	Stockport	252	20 to 40	33·64	292	153	5	450	949 3 11	138·61
33	New Bridge Mills Twist Company	Manchester	264	115 to 195	155	444	..	6	450	866 5 0	120·75
34	Apelles Howard	Brinnington	266	14 to 40	36·39	176	268	2	446	881 11 9½	123·05
35	Jas. and John Potter	Manchester	265·8	12 to 36	24	238	173	33	444	967 7 3	130·72

36	Samuel Stocks .	Heaton Mersey.	276	20 to 40	36·25	177	259	2	438	816	4	8	111·81
37	T. and R. Barnes	New Mills . .	240	..	..	437	..	..	437	756	8	1	119·43
38	James and R. Gee	Cheadle Bulkeley . . .	299·83	36 to 40	38	211	208	14	433	952	11	7	121·50
39	Charles Axon .	Stockport . .	253	36 to 38	36·8	189	213	17	419	818	4	10½	127·82
40	Thomas Harbottle .	Manchester .	276	18 to 65	27·81	126	267	8	401	739	18	9	110·71
41	Thomas Fernley. .	Stockport . .	Above 18 288 Under 18 276	36 to 40	38	116	279	5	400	949	16	9	138·58
42	J. and R. Ashton .	Hyde . . .	270·5	18 to 40	31·81	155	240	2	397	907	13	3½	139·96
43	Benjamin Gray . .	Manchester . .	276	100 to 200	130	388	..	3	391	739	13	1	113·50
44	Ralph Orrell . . .	Brinnington .	273	19 to 38	26·5	194	190	4	388	842	7	6	131·69
45	G. T. Knowles . .	Stockport . .	276	12 to 36	19·33	143	243	1	387	782	1	2	121·24
46	Benjamin Sandford .	Manchester . .	276	140 to 210	175	365	..	17	382	719	1	1	112·94
47a	Hadfield and Frost .	Warrington. .	276	31 to 42	36·5	143	..	4	350	716	0	0½	112·68
47b	Ditto	Ditto . . .	276	..	..	..	192	11					130·06
48	Thomas Robinson .	Stockport . .	264	40	40	123	219	7	349	850	1	5½	152·78
49	Dacca Twist Company	Manchester. .	282	16 to 38	24	180	155	13	348	730	19	11	123·35
50	Thos. Ogden and Sons	Ditto . . .	276	30 to 170	43·29	344	..	2	346	726	13	7	126·01
51	Thomas Plant . .	Ditto . . .	276	140 to 210	175	342	..	1	343	642	5	1	112·34
52	Samuel Ratcliff. .	Oldham . .	207	12 to 50	1	186	153	3	342	553	7	5	129·44
53	Hardy and Andrew .	Stockport . .	Above 18 296 Under 18 276	7 to 30	18·50	310	6	3	319	516	14	5	93·57
54	Mosley and Howard	Disley . . .	276	38 to 46	42	233	76	10	319	636	17	6	119·78
55	John Brown . . .	Stockport . .	294·5	14 to 38	30·78	156	154	2	312	694	12	0	125·18
56	John Tattersall . .	Oldham. . .	276	..	50	116	188	..	304	594	8	0	117·31
57	Roger Holland & Co.	Bolton . . .	274·5	24 to 130	72·85	277	3	18	298	669	16	0	135·59

TABLE OF COTTON MILLS (*continued*).

	Name of Firm.	Town or Place in or near which the Mills are situate.	Hours during which the Mill worked in the Month ending May 4, 1833.	Counts spun.	Average Counts spun.	Number of Persons engaged in preparing and spinning Cotton.	Number of Persons engaged in Weaving.	Number of Persons engaged as Engineers, Mechanics, Roller Coverers, &c.	Total Number employed.	Total NET Earnings realized by the Total NUMBER of Persons given in the preceding Column during the Month ending 4th May 1833, and for working the Number of Hours given in the Third Column.	Average Weekly Net Earnings of each Individual, calculated for 69 Hours.
										£. s. d.	Pence.
58	Rooth and Mayer	Stockport	270	40	40	112	176	1	289	536 4 7	113·80
59	T. Steel and Son.	Ditto	Above 18: 296; Under 18: 276	36 to 38	37	140	122	22	284	659 5 8	133·82
60	Trustees of Josiah Cheetham	Tintwistle	273	20 to 36	28	7	184	7	278	730 17 5	159·47
61	John Sidebottom	Hyde.	Spinning rooms 276; Other rooms 300	36	36	107	169	..	276	656 7 11½	133·72
62	James Lord	Manchester	210	..	..	..	253	20	273	429 5 9½	124·00
63	D. Dronsfield	Oldham	276	28 to 40	34	177	92	..	269	576 4 5	128·52
64	W. Higson	Stockport	291	14 to 20	17	99	166	..	265	541 0 1	117·17
65	C. Ainsworth and Co.	Bolton	276	20 to 140	100	235	13	3	251	488 16 7½	116·85
66	Peter Ewart	Manchester	273	6 to 26	16·75	250	..	1	251	424 8 6	102·57
67	John Garside	Brinnington	266	18 to 24	21	112	132	1	245	581 17 1½	147·85
68	Richard Thompson	Oldham	252	24 to 60	49·48	211	23	7	241	480 4 6	130·94
69	T. Barton and Co.	Manchester	272·5	14 to 24	20	105	135	..	240	505 7 2	127·96
70	J. and W. Bellhouse	Ditto	276	130 to 210	170	208	..	3	211	522 2 2	148·46
71	Abraham Haigh	Bolton	276	60 to 150	110	209	..	1	210	425 9 6	121·56

72	Adshead & Brothers.	Duckenfield .	Above 18 296 Under 18 276	36 to 54	45	204	..	5	209	504	18	3	137·92
73	Blackstock and Bowers . . .	Levenshulme .	276	18 to 24	21	68	136	..	204	570	3	11½	167·70
74	E. and T. Dodgshon.	Manchester. .	270	17 to 20	18·5	79	119	5	203	434	7	4	131·23
75	J. and J. Hague .	Oldham . . .	274	30, 40 & 55	41·66	149	51	3	203	399	7	3	118·89
76	Wagstaff and Side-bottom . . .	Duckenfield. .	296	40 to 140	90·20	196	..	6	202	468	17	9	129·86
77	Taylor, Weston, and Co.. . . .	Manchester .	Above 18 288 Under 18 276	18 to 40	32·16	180	10	8	198	317	14	0	93·84
78	William Higgins .	Ditto . . .	270·5	13 to 40	22	180	..	16	196	382	5	5	119·40
79	Henry Lees . . .	Glossop . . .	272	34 to 40	38	64	126	1	191	421	10	1½	133·35
80	S. M. Moore . . .	Manchester . .	276	150 to 210	180	186	..	3	189	407	19	3	129·49
81	James Hall and Son	Stayley Bridge	Above 21 299 Under 21 276	8 to 40	30·75	185	..	2	187	381	0	8	..
82	Alexander M'Cool .	Bolton . . .	276	60 to 100	80	185	..	1	186	419	16	8¼	135·43
83	Ogden and Walmsley	Oldham. . .	252	38	38	82	104	..	186	333	15	9	117·92
84	Hugh Shaw and Co..	Manchester . .	276	150 to 210	180	181	..	1	182	339	3	1	111·80
85	A. W. Thornileyand Brothers. . .	Duckenfield .	280	35 to 40	39	121	60	1	182	403	0	1½	130·96
86	The Pin Mill Twist Company. . .	Manchester . .	272·8	14 to 22	18	76	105	..	181	406	9	4½	136·32
87	Robinson and Ar-mitage . . .	Duckenfield .	276	36 to 40	38	76	94	3	173	417	9	1	144·78
88	Seville and Wright .	Oldham . . .	252	24 to 30	27	166	2	4	172	290	10	0	110·98

TABLE OF COTTON MILLS (continued).

	Name of Firm.	Town or Place in or near which the Mills are situate.	Hours during which the Mill worked in the Month ending May 4, 1838	Counts spun.	Average Counts spun.	Number of Persons engaged in preparing and spinning Cotton	Number of Persons engaged in Weaving	Number of Persons engaged as Engineers, Mechanics, Roller Coverers, &c.	Total Number employed.	Total NET Earnings realized by the Total NUMBER of Persons given in the preceding Column during the Month ending 4th May 1838, and for working the Number of Hours given in the Third Column. £. s. d.	Average Weekly Net Earnings of each Individual, calculated for 69 Hours. Pence.
89	F. S. Clayton	Stockport	Above 18 288 5, Under 18 270·5	..	.	..	155	..	155	348 13 1	131·71
90	J. Rothwell	Bolton	276	90 to 120	105	150	..	1	151	291 0 0	115·62
91	Barker & Ainsworth	Warrington	276	50 to 80	65	144	..	5	149	230 4 0	92·69
92	H. Marsland & Co.	Stockport	Spinners 267, Weavers 264	36 to 60	43	43	102	1	146	359 16 7	154·06
93	Assignees of James Gleadhill	Oldham	255	12 to 40	27·5	142	..	4	146	260 18 11	116·06
94	Joseph Walsh	Warrington	299	30	30	61	81	3	145	287 13 1	109·87
95	Samuel Shepley	Glossop	288	40	40	144	..	..	144	232 13 8	92·91
96	Nathan Gough	Manchester	276	28 to 36	30·75	139	..	5	144	193 18 9	80·80
97	William Carruthers	Ditto	276	150 to 210	180	143	..	..	143	348 11 0	146·24
98	John Winterbottom	Tintwistle	308	38 to 46	42	126	..	8	134	303 11 5	121·80
99	Smith and Rawson	Manchester	276	22 to 30	26	128	..	5	133	211 12 4½	95·46
100	Welsh and Sells	Ditto	276	40	40	46	86	..	132	292 18 7	133·14
101	Gould and Cooper	Oldham	248	20 to 50	35	82	48	..	130	240 16 4	123·69
102	France & Boardman	Manchester	277	..	..	..	122	2	124	224 0 2½	108·39
103	S. Forster and Co.	Ditto	276	30	30	42	75	4	121	252 6 11	125·13
104	J. and R. Howard	Stayley Bridge	276	40	40	114	..	1	115	263 7 6½	137·41
105	Wimpenny and Swindells	Duckenfield	286	40	40	110	..	3	113	236 18 4	121·39
106	Haywood and Sons	Manchester	279	155 to 175	165	109	..	3	112	231 18 10	122·91

107	Broadbent & Sons	Oldham	Carding room 252 Spinning room 246	20 to 40	30	104	..	2	106	241	2	4	151·90
108	W. Sidebottom	Werneth	262	36	36	31	74	..	105	251	4	11½	151·24
109	Johnson & Brooks	Manchester	276	17 to 20	18·5	42	60	3	105	186	6	8	106·44
110	James Wilkinson	Stayley Bridge	296	40	40	104	..	..	104	244	6	8	131·43
111	John Clegg	Oldham	276	14 to 32	26	49	48	2	99	180	18	8	109·64
112	Robert Shepley	Glossop	282	34 to 38	36	98	..	..	98	196	14	9	117·88
113	Edward Brideoak	Oldham	276	20 to 50	36	95	2	..	97	167	14	1½	103·73
114	C. Bradbury	Ditto	276	20 to 80	50	94	..	1	95	201	14	2	127·39
115	Ogden and Walmsley	Ditto	252	38.	38	10	80	..	90	170	8	6½	124·43
116	Edmund Wilde	Ditto	276	20 to 26	23	90	..	..	90	128	16	9	85·89
117	Abraham Clegg	Ditto	252	7 to 30	16	88	..	..	88	146	12	9½	109·50
118	James Wardlow	Glossop	288	38, 40, & 42	40	87	..	..	87	187	9	8	123·91
119	John Lees	Ditto	296	38 to 42	40	86	..	1	87	168	17	9½	108·60
120	Robert Schofield	Manchester	276	124 to 150	137	87	..	..	87	134	3	0½	92·51
121	John Barker	Glossop	276	32, 40, & 50	40·66	84	..	2	86	175	10	8½	122·46
122	Ralph Sidebottom	Tintwistle	295·58	46	46	84	..	2	86	173	4	5	112·84
123	Buckley and Howard	Stayley Bridge	288	40	40	82	..	..	82	180	19	1½	126·89
124	The Islington Twist Company	Manchester	276	28 to 34	30·25	76	..	1	77	121	2	9½	94·39
125	J. Stanney	Mellor	276	36, 38, & 60	44·66	39	37	..	76	100	16	11	79·61
126	S. Thornley and Co.	Levenshulme	276	20	20	22	50	3	75	166	14	7½	133·38
127	Daniel Nield, jun.	Oldham	276	20 to 30	23·33	48	26	..	74	139	1	5½	112·76
128	Hugh Shaw	Duckenfield	276	..	..	23	50	..	73	172	8	0	141.69
129	T. and R. Hope	Manchester	279·75	..	..	..	73	..	73	141	17	1	115·02
130	Clare, Crosfield, and Sowden	Warrington	276	34 to 36	35	72	..	..	72	86	6	6	71·93
131	Samuel Armstrong	Disley	214·5	24 to 36	32	68	..	..	68	92	9	2	104·97
132	Sibson Rigg	Manchester	264	20 to 26	23	66	..	..	66	105	12	11	100·40
133	John Duncuft	Oldham	238	40 to 60	50	60	..	..	60	121	3	1½	140·50

TABLE OF COTTON MILLS (*continued*).

	Name of Firm.	Town or Place in or near which the Mills are situate.	Hours during which the Mill worked in the Month ending May 4, 1833.	Counts spun.	Average Counts spun.	Number of Persons engaged in preparing and spinning Cotton.	Number of Persons engaged in Weaving	Number of Persons engaged as Engineers, Mechanics, Roller Coverers, &c.	Total Number employed.	Total NET Earnings realized by the Total NUMBER of Persons given in the preceding Column during the Month ending 4th May 1833, and for working the Number of Hours given in the Third Column. £. s. d.	Average Weekly Net Earnings of each Individual, calculated for 69 Hours. Pence.
134	Joseph Cooper	Glossop	Under 18 276 Adults 300	60	60	52	..	1	53	99 15 7	108·50
135	James Nield, jun.	Oldham	276	20 to 26	23	53	..	..	53	84 17 2½	96·06
136	Joseph Howard	Glossop	296	50	50	52	..	..	52	113 17 0	122·48
137	J. and J. Bennett	Ditto	294	40	40	49	..	3	52	94 12 9	102·51
138	Waring and Sons	Oldham	276	2 to 40	26	49	..	..	49	84 1 2	103·47
139	Parrott and Weston	Brinnington	267	36	36	47	..	..	47	113 6 0	149·54
140	C. Bullock	Manchester	270	18 to 42	25·02	47	..	..	47	85 19 5	112·18
141	Cheetham and Hill	Duckenfield	296	50 to 60	55	44	..	1	45	102 6 5	127·20
142	James Kershaw	Charlestown	308	33, 35, & 36	34·66	44	..	..	44	97 14 5	119·41
143	M. Hadfield	Glossop	286	40	40	43	..	..	43	95 15 8	128·97
144	John Cheetham	Stockport	282	20 to 26	23	36	2	1	39	66 17 5	100·68
145	Aaron Rangeley	Hayfield	276	40	40	38	..	..	38	69 18 0	110·36
146	Rusby and Linney	Glossop	Under 18 264 Above 300	20 to 24	22	37	..	..	37	62 7 10	100·58
147	Moss and Howard	Oldham	276	36	36	28	..	..	28	84 8 3	180·88
148	George Platt	Glossop	286	40	40	27	..	..	27	45 16 4	98·25
149	J. Greaves	Mottram	240	38 to 42	40	26	..	..	26	60 0 0	159·23
150	Joseph Lamb	Stockport	282	20 to 24	22	25	1	..	26	44 9 1	100·40
151	George Froggatt	Mellor	267	8	8	19	..	..	19	31 4 9½	101·97
						31,444	16,040	1,161	48,645	100,971 18 11¼	125·13

SUPPLEMENT (A.) (GENERAL).—Showing the Distribution of the 48,645 Hands (employed in the 151 Mills given in the preceding List) in the different Places mentioned, their Ages, Sex, &c., the Aggregate Net Earnings of the whole Number, and the Average Net Earnings of an Individual, in each Place, for 69 Hours' Work.

Place of Employment.	Adults.*		Children under Eighteen Years						Average Number employed.	Aggregate Number of Hours worked by the whole during the Month ending 4th of May, 1833.	Total Number of Hours worked by each.	Aggregate Amount of their Net Earnings for the Month ending 4th May, 1833.			Average Weekly Net Earnings of each Individual, calculated for 69 Hours.
			Males.			Females.									
	Males.	Females.	In the direct Employ of Masters.	In the direct Employ of Operatives.	Employers uncertain.	In the direct Employ of Masters.	In the direct Employ of Operatives.	Employers uncertain.				£.	s.	d.	Pence.
Manchester and immediate neighbourhood	4,421	5,731	1,423	2,349	29	1,957	1,451	29	17,390	4,737,977·1	272·4	35,089	2	3½	122·64
Stockport and Heaton Norris	2,314	2,175	609	917	30	883	525	38	7,491	2,057,002·0	274·5	16,399	7	6¾	132·02
Duckenfield & Stayley Bridge	1,251	1,256	87	458	7	240	192	25	3,516	1,016,789·0	289·1	7,822	2	6	127·39
Hyde, Brinnington, &c.	1,936	2,451	698	598	27	1,402	127	10	7,249	2,020,639·5	278·7	16,629	6	0½	136·28
Tintwistle, Glossop, &c.	728	675	108	445	19	262	227	18	2,482	678,228·7	273·2	4,951	4	0	120·89
Oldham	1,318	824	198	575	40	506	276	38	3,775	987,294·0	261·5	7,577	3	3	127·09
Bolton	1,443	1,279	356	1,069	..	657	665	..	5,469	1,510,984·0	276·2	10,174	8	0¼	111·50
Warrington	207	235	38	105	..	63	68	..	716	200,951·0	280·6	1,320	3	7½	108·79
One Mill at Bury	122	195	68	41	..	121	10	..	557	152,339·5	273·5	1,009	1	7¼	109·69
	13,740	14,821	3,585	6,557	152	6,091	3,541	158	48,645	13,362,204·8	274.6	100,971	18	11¼	125.18

* The word "Adult" is used throughout these Tables to signify a Person who has completed the Eighteenth year of age.

SUPPLEMENT (B.) (GENERAL).—Distributing the 48,645 Hands into Eight different Branches or Departments of Cotton Working, and showing the Aggregate Net Earnings of the whole Number of the Operatives in each Branch, and the Average Net Earnings of an Operative in each, for 69 Hours' Work.

Employed in	Adults.		Children under Eighteen Years.						Total Number employed.	Aggregate Number of Hours worked by the whole, during the Month ending the 4th May, 1833.	Average Number of Hours worked by each	Aggregate Amount of their Net Earnings for the Month ending 4th May, 1833.	Average Weekly Net Earnings of each Individual, in each Branch, calculated for 69 Hours.
			Males.			Females.							
	Males.	Females	In the direct Employ of Masters.	In the direct Employ of Operatives.	Employers uncertain.	In the direct Employ of Masters.	In the direct Employ of Operatives.	Employers uncertain.				£. s. d.	
Cleaning & spreading cotton	272	689	212	1	9	94	2	3	1,282	353,660.5	275.8	2,111 1 5	98.85
Carding	2,350	3,501	1,229	81	18	2,061	117	40	9,397	2,591,188.7	275.7	17,252 16 8¼	110.26
Mule-spinning	5,163	1,189	697	5,852	50	346	2,284	24	15,605	4,291,208.6	274.9	33,057 12 2¾	127.57
Throstle-spinning	194	688	373	4	32	500	4	51	1,846	501,621.5	271.7	2,819 1 6¼	93.06
Reeling	146	2,552	40	5	..	542	23	8	3,316	906,261.8	273.2	5,213 14 3¼	95.26
Weaving	4,627	6,108	986	610	35	2,538	1,104	32	16,040	4,400,274 7	274.3	36,080 19 11	135.78
Roller covering	61	87	5	1	..	9	7	..	170	47,268.3	278.0	414 15 7	145.31
As engineers, firemen, mechanics, &c.	927	7	43	3	8	1	..	..	989	270,720.7	273.7	4,021 17 2¾	246.01
	13,740	14,821	3,585	6,557	152	6,091	3,541	158	48,645	13,362,204 8	274.6	100,971 18 11¼	125.13

SUPPLEMENT (C.) (GENERAL).—Showing the Number of Children under Fourteen years of Age comprehended in the Total Number of 48,645 Hands, the Aggregate Net Earnings of the whole Number of Children under Fourteen, and the Average Net Earnings of a Child under Fourteen, for 69 Hours' Work.*

Place of Employment.	Persons Eighteen Years of Age and upwards.			Persons above Fourteen and under Eighteen.			Children under Fourteen.				Average Net Earnings per Week of each Child under 14.
	Males.	Females	Total Number	Males.	Females.	Total Number.	Males.	Females	Total Number	Aggregate Net Earnings of the whole Number of Children for the Month ending 4th May 1833.	
										£. s. d.	
Manchester and immediate Neighbourhood	4,421	5,731	10,152	1,514	1,887	3,401	2,287	1,550	3,837	2,861 3 9¼	44.74
Stockport and Heaton Norris	2,314	2,175	4,489	583	777	1,360	973	669	1,642	1,370 15 8	50.08
Duckenfield and Stayley Bridge	1,251	1,256	2,507	232	163	395	320	294	614	480 2 5¼	46.91
Hyde, Brinnington, &c.	1,936	2,451	4,387	666	924	1,590	657	615	1,272	1,256 1 5¼	59.24
Tintwistle, Glossop, &c.	728	675	1,403	324	252	576	248	255	503	422 4 4¼	50.36
Oldham	1,318	824	2,142	371	422	793	442	398	840	603 9 0	43.10
Bolton	1,443	1,279	2,722	570	637	1,207	855	685	1,540	956 14 3¼	37.27
Warrington	207	235	442	53	55	108	90	76	166	109 5 8	39.50
One Mill at Bury	122	195	317	40	73	113	69	58	127	83 17 8¼	39.63
	13,740	14,821	28,561	4,353	5,190	9,543	5,941	4,600	10,541	8,143 14 5¼	46.35

Of which total number of 10,541 Children under the age of 14,—There are in the direct employ of the mill owners . 3,931
Ditto ditto of operatives . . . 5,898
And of those whose direct employer is unknown . . 712
10,541

* The statement of time worked by Children under 14, and also of Engineers, is to be taken with the modification specified in the Preface, page 5. This remark is to apply throughout.

SUPPLEMENT (D.) (GENERAL).—The 48,645 Hands exhibit the following Proportions in 100, of Persons above Eighteen years of Age, of Persons above Fourteen and under Eighteen, and of Children under Fourteen. The Proportions of the Sexes of each Age are likewise exhibited.

Place of Employment.	Adults.		Persons above Fourteen and under Eighteen.		Children under Fourteen.		Total Adults.	Total Non-Adults.	Total Males.	Total Females.
	Males.	Females.	Males.	Females.	Males.	Females				
Manchester and immediate Neighbourhood . . .	25.42	32.96	8.71	10.85	13.15	8.91	58.35	41.62	47.28	52.72
Stockport and Heaton Norris .	30.87	29.06	7.78	10.37	12.99	8.93	59.93	40.07	51.64	48.36
Duckenfield and Stayley Bridge	35.58	35.72	6.60	4.64	9.10	8.36	71.30	28.70	51.28	48.72
Hyde, Brinnington, &c. . . .	26.71	33.81	9.19	12.75	9.06	8.48	60.52	39.48	44.96	55.04
Tintwistle, Glossop, &c. . . .	29.33	27.20	13.06	10.15	9.99	10.27	56.53	43.47	52.38	47.62
Oldham.	34.91	21.83	9.83	11.18	11.71	10.54	56.74	43.26	56.45	43.55
Bolton	26.38	23.39	10.42	11.65	15.63	12.53	49.77	50.23	52.43	47.57
Warrington	28.91	32 82	7.40	7.68	12.57	10.62	61.73	38.27	48.88	51.12
One Mill at Bury	21.90	35.01	7.18	13.11	12.39	10.41	56.91	43.09	41.77	58.53
Total Average . .	28.24	30.47	8.95	10.67	12.21	9.46	58.71	41.29	49.40	50.60

SUPPLEMENT (E.) (GENERAL.)—Showing the Average Net Earnings of certain Classes of Operatives employed in the Four Processes of Carding, Mule-spinning, Throstle-spinning, and Weaving, in all the Districts, as specified in Supplement (C.)

Denomination of Process in which employed.	Class of Operatives.	Classification as respects Sex and Age.	Total Number of Persons employed.	Total Number of Hours worked by them, during the Month ending 4th May, 1833.	Average Number of Hours worked by each.	Aggregate Net Earnings for the Month ending 4th May, 1833. £. s. d.	Average Weekly Net Earnings of each Individual in each Process, calculated for 69 Hours. Pence.
Carding	Carders or overlookers	Male adults	376	103,495·9	275·2	1,762 17 3¼	282·06
	Jack-frame tenters	Principally female adults	696	190,385·0	273·5	1,103 10 3¼	95 98
	Bobbin-frame tenters	Ditto ditto	945	261,650·1	276 8	1,414 3 5	89·50
	Drawing tenters	Ditto ditto	1,931	532,287·3	275·6	2,885 3 8¼	89 76
Mule-spinning	Overlookers	Male adults	145	40,018·6	275·9	848 2 2	350·95
	Spinners	Male and female adults, but principally the former	3,797	1,046,252·0	275·5	19,454 3 5	307·91
	Piecers	Male and female adults and non-adults but principally the latter	7,157	1,966,804·8	274·8	7,688 14 8¼	64·73
	Scavengers	Male and female non-adults	1,247	340,019·1	272·6	712 2 11½	34·68
Throstle-spinning	Overlookers	Male adults	82	22,371·9	272·8	362 14 11¼	268·51
	Spinners	Female adults and non-adults	1,123	305,712 4	272·2	1,716 17 6¼	93·00
Weaving	Overlookers	Male adults	400	109,577 0	273 9	2,088 1 4	315·56
	Warpers	Male and female adults	332	90,660·2	273·0	805 5 0	147·08
	Weavers	Male and female adults, male and female non-adults, but chiefly females	10,171	2,784,258 7	273·7	21,835 9 6¼	129·87
	Dressers	Male adults	836	230,771·0	276 0	4,650 4 11	333·69

SUPPLEMENT (F.) (GENERAL).—Showing the Average Net Earnings per Week of Sixty-nine Hours of each Class of Operatives employed in the Eight different Branches of Cotton Working in the under-mentioned Districts.

Employed in	Manchester and its immediate Neighbourhood.	Stockport and Heaton Norris.	Duckenfield and Stayley Bridge.	Hyde, Brinnington, &c.	Tintwistle, Glossop, &c.*	Oldham.	Bolton.	Warrington.	Average Weekly Net Earnings of each Individual in each Branch, calculated for 69 Hours.
	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.
Cleaning and spreading cotton	84·68	174·14	80·52	162·70	267·69	103·13	91·35	67·27	98·85
Carding	118·59	107·31	120·37	113·28	110·79	107·02	92·22	90·31	110·26
Mule-spinning	126·96	135·99	125·47	132·78	123·71	138·06	122·14	107·11	127·57
Throstle-spinning	93·67	99·29	108·07	90·60	96·00	82·11	95·24	58·02	93·06
Reeling	97·65	96·70	94·34	88·20	90·00	100·85	86·14	77·24	95·26
Weaving	127·41	136·80	142·20	144·63	141·36	131·10	123·74	122·06	135·78
Roller covering	145·87	155·32	136·01	160·30	86·18	176·50	152·45	103·45	145·31
As engineers, mechanics, firemen, &c.	255·36	265·66	206·36	217·13	229·40	252·08	211·45	231·76	246·01
Total Average	122·64	132·02	127·39	136·28	120·89	127·09	111·50	108·79	125·13

* None but adults are returned as employed in this department in Tintwistle, &c.

SUPPLEMENT (G.) (GENERAL).—Showing the Average Net Earnings per Week of Sixty-nine Hours of certain Classes of Operatives employed in the Four Processes of Carding, Mule-spinning, Throstle-spinning, and Weaving, in the under-mentioned Districts

Denomination of Process in which employed	Class of Operatives	Manchester and its immediate Neighbourhood	Stockport and Heaton Norris	Duckenfield and Stayley Bridge	Hyde Bredbury &c	Tintwistle Glossop &c	Oldham	Bolton	Warrington	Average Weekly Net Earnings of each Individual in each Process, calculated for 69 Hours
		Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence	Pence
Carding	Carders or overlookers	314 46	283 65	249 60	245 73	259 11	304 13	256 94	209 87	282 06
	Jack frame tenters	103 26	111 64	102 01	100 2	97 21	91 0	62 54	69 52	95 98
	Bobbin frame tenters	103 92	95 46	95 57	111 96	94 8	76 26	67 94	73 9	89 50
	Drawing tenters	101 73	92 38	92 5	76 48	87 78	95 31	70 82	72 91	89 76
Mule spinning	Overlookers	392 55	314 69	311 25	363 94	364 90	277 30	303 43	345 60	350 95
	Spinners	325 64	291 40	247 90	281 79	274 80	312 68	341 71	287 75	307 91
	Piecers	[illegible] 37	70 41	66 34	55 8	58 96	74 03	56 10	59 82	64 73
	Scavengers	33 15	39 87	43 05	42 65	41 49	30 92	33 33	29 86	34 68
Throstle-spinning	Overlookers	281 10	284 40	237 50	226 64	296 28	270 68	217 41		268 51
	Spinners	91 85	00 03	102 40	102 89	104 23	79 37	90 21	56 01	93 00
Weaving	Overlookers	293 86	354 81	2 1 91	308 14	373 44	295 81	292 56	270 72	315 56
	Warpers	142 35	147 86	121 6	150 2	15 5	150 50	1 2 87	131 05	147 08
	Weavers	129 93	198 25	13 47	137 50	137 60	1 8 51	111 19	141 65	129 97
	Dressers	3 3 0	349 36	290 8	344 89	345 63	353 48	256 03	369 04	333 69

SUPPLEMENT (H.) (LOCAL).—Distributing the 17,390 Operatives employed in Manchester and in the immediate Neighbourhood, and concerning whom complete Returns were obtained, into the Eight different Branches of Cotton-working specified in General Supplement (B.), and exhibiting similar Results.

Employed in	Adults.		Children under Eighteen Years.						Total Number employed	Total Number of Hours worked by them during the Month ending 4th May, 1833.	Average Number of Hours worked by each.	Aggregate Net Earnings for the Month ending 4th May, 1833.	Average Weekly Net Earnings of each Individual in each Branch, calculated for 69 Hours.
			Males.			Females.							
	Males.	Females	In the Employ of Masters.	In the Employ of Operatives.	Employers uncertain.	In the Employ of Masters.	In the Employ of Operatives	Employers uncertain.					
												£. s. d.	Pence.
Cleaning and spreading cotton . .	92	493	152	..	..	68	..	1	806	220,674·9	273·7	1,128 9 0¼	84·68
Carding	783	1,352	404	3	5	579	41	..	3,167	866,545·1	273·6	6,205 17 4	118·59
Mule-spinning . .	1,745	606	364	2,147	12	233	1,058	7	6,172	1,690,261·1	273·8	12,959 3 10¼	126·96
Throstle-spinning .	90	388	181	..	9	286	..	18	972	265,255·6	272·8	1,500 8 4	93·67
Reeling	67	1,446	36	1	..	277	..	3	1,830	502,030·9	274·3	2,960 12 6	97·65
Weaving	1,127	1,407	251	197	..	507	347	..	3,836	1,029,429·1	268·3	7,920 14 10¼	127·41
Roller covering . .	16	34	..	1	..	6	5	..	62	16,901·6	272·6	148 17 7¼	145·87
And as engineers, mechanics, firemen, &c.	501	5	35	..	3	1	..	..	545	146,878·8	269·5	2,264 18 8¼	255·36
	4,421	5,731	1,423	2,349	29	1,957	1,451	29	17,390	4,737,977·1	272·4	35,089 2 3¼	122·64

SUPPLEMENT (H.)—*continued.*

In addition to the number of 17,390 Operatives, concerning whom complete Returns were obtained from Manchester and the immediate Neighbourhood, incomplete Returns were obtained regarding 5,052 others who were either employed in Mills working both night and day, or the duration of whose work was not stated by the hour. The Distribution of the total Number of 22,442, and the Aggregate of their Net Earnings, is as under. See List II., incomplete Returns.

Employed in.	Total Number employed.	Aggregate Net Earnings for the Month ending 4th May, 1833. £.	s.	d.
Cleaning and spreading cotton	912	1,275	6	8½
Carding	3,986	7,713	10	5½
Mule-spinning	7,458	15,767	8	1
Throstle-spinning	1,190	1,814	11	2½
Reeling	2,526	4,024	1	11½
Weaving	5,672	11,815	8	10½
Roller covering	82	202	18	8
And as engineers, mechanics, firemen, &c.	616	2,551	3	5½
	22,442	45,164	9	5

Supplement (I.) (Local.)—Showing the Average Net Earnings of certain Classes of Operatives employed in the Four Processes of Carding, Mule-spinning, Throstle-spinning, and Weaving, in Manchester and immediate Neighbourhood.

Denomination of Process in which employed	Class of Operatives.	Classification as respects Sex and Age	Number of Persons employed.	Total Number of Hours worked by them during the Month ending 4th May, 1833	Average Number of Hours worked by each.	Aggregate Net Earnings for the Month ending 4th May, 1833.	Average Weekly Net Earnings of each Individual in each Process, calculated for 69 Hours.
						£ s d	Pence
Carding	Carders or overlookers	Male adults	121	33,084·5	273·4	628 5 1½	314 46
	Jack-frame tenters	Principally female adults	192	52,600 7	273 9	330 2 0¼	103·26
	Bobbin-frame tenters	Ditto ditto	182	49,841·0	273·8	310 15 11¼	103 92
	Drawing tenters	Ditto ditto	638	174,129·7	272·9	1,069 15 8½	101·73
Mule-spinning	Overlookers	Male adults	57	15,565·3	273·0	368 19 7	392·55
	Spinners	Male and female adults, but principally the former	1,435	392,409 9	273·4	7,716 12 11½	325·64
	Piecers	Male and female adults and non-adults, but principally the latter	2,697	738,404·9	273·7	3,137 16 11¼	70 37
	Scavengers	Male and female non adults	884	241,598·1	273·3	483 14 2	33·15
Throstle-spinning	Overlookers	Male adults	39	10,699·6	274·3	181 12 6	281·10
	Spinners	Female adults and non-adults	596	162,720 5	273·0	902 12 8	91·85
Weaving	Overlookers	Male adults	95	25,144·1	264·6	446 3 9	293 86
	Warpers	Male and female adults	86	23,428 8	272 4	201 8 1	142·35
	Weavers	Male and female adults, Male and female non-adults, but chiefly females	2,021	536,923·4	265·6	4,212 17 6	129 93
	Dressers	Male adults	133	36.415 7	273·8	711 16 6	323·70

TABLE I.—Total of Cotton Factories worked by Mechanical Power, in the United Kingdom, according to the Inspectors' Returns of 1835.

Countries.	Number of Factories.		Number and Ages of Persons employed.														
			Between 8 and 12 Yrs			Between 12 and 13 Yrs.			Between 13 and 18 Yrs.			Above 18 Yrs.			Total Persons.		
	At work	Empty.	Males.	Females	Total	Males	Females.	Total	Males	Females.	Total.	Males	Females	Total.	Males.	Females.	Total.
England ..	1,070	42	4,030	3,073	7,103	9,196	7,865	17,061	23,974	29,869	53,843	50,675	53,410	104,085	87,875	94,217	182,092
Wales	5	...	...	..	...	56	33	89	146	208	354	250	458	708	452	699	1,151
Scotland....	159	...	454	538	992	1,258	1,832	3,090	2,845	7,597	10,442	6,168	12,403	18,571	10,529	22,051	32,580
Ireland ...	28	...	44	58	102	153	181	334	286	561	847	960	1,553	2,513	1,639	2,672	4,311
Total.....	1,262	42	4,528	3,669	8,197	10,663	9,911	20,574	27,251	38,235	65,486	58,053	67,824	125,877	100,495	119,639	220,134

TABLE II.—Total of Children, Young Persons, and Adults in all the Factories of the United Kingdom.

Totals.	Number of Factories at Work.	Number and Ages of Persons employed.														
		Between 8 and 12 Yrs.			Between 13 and 18 Yrs			Totals			Above 18 Years.			Total Persons.		
		Males	Females.	Total.	Males	Females	Total.	Males	Females	Total.	Males.	Females	Total.	Males.	Females.	Total.
England...	2,555	9,292	9,536	18,828	53,114	65,218	115,332	62,406	74,754	137,160	75,848	80,685	156,533	138,254	155,439	293,693
Wales.....	90	47	29	76	485	403	888	532	432	964	448	524	972	980	956	1,936
Scotland....	425	690	842	1,532	6,420	14,722	21,142	7,110	15,564	22,674	8,904	19,117	28,021	15,818	34,362	50,180
Ireland.....	90	58	94	152	1,150	2,563	3,713	1,208	2,657	3,865	2,099	3,085	5,184	3,503	6,061	9,564
Total......	3,160	10,087	10,501	20,588	61,169	82,906	144,075	71,256	93,407	164,663	87,299	103,411	190,710	158,555	196,818	355,373

TABLE of the Working Power employed in the Cotton Factories of England.*

Counties.	Number of Factories.		Motive Force.							Number and Age of Persons Employed.		
			Number of			Amount estimated according to the Power of same in Horses.			Power actually employed.	Between Eight and Twelve Years.		
	At Work.	Empty	Steam-Engines.	Water Wheels.	Total.	Steam.	Water	Total.		Males.	Females.	Total.
Chester . . .	109	7	170	53	223	5,055	1,266	6,321	5,598	425	406	831
Cumberland . .	13	..	..	..	..	..	..	..	..	8	4	12
Derby	32	..	..	..	..	..	..	..	..	87	97	184
	60	3	33	58	91	553	853	1,406	1,270	95	95	190
Durham . . .	1	..	..	..	..	..	..	..	..	..	..	..
Lancaster . . .	683	32	714	233	947	20,302½	2,851	23,153½	21,207½	2,806	1,983	4,789
Leicester . . .	6	..	..	..	..	..	..	..	..	9	..	9
Middlesex . . .	7	..	..	..	..	..	..	..	..	22	..	22
Nottingham . .	20	..	..	..	..	..	..	..	..	17	23	40
Stafford . . .	9	..	..	..	..	..	..	..	..	35	49	80
	4	..	3	2	5	50	60	150	134	37	33	70
York, West Riding	126	..	75	129	204	1,317	1,403	2,720	2,231½	489	387	876
Total . .	1,070	42	..	..	..	..	..	..	..	4,030	3,073	7,10

* Excepting the Northern District under Mr. Horner's inspection. See his Table, pp. 356, 357.

TABLE of the Numbers and Ages of Persons in the Cotton Factories of the different Counties of England.

Counties.	Number and Age of Persons Employed—(*continued.*)											
	Between Twelve and Thirteen Years.			Between Thirteen & Eighteen Years.			Above Eighteen Years.			Total Persons.		
	Males.	Females	Total.	Males.	Females	Total.	Males.	Females	Total.	Males.	Females.	Total.
Chester	1,448	1,206	2,654	3,672	4,315	7,987	9,971	10,069	20,040	15,516	15,996	31,512
Cumberland	57	38	95	169	332	501	392	658	1,050	626	1,032	1,658
Derby	261	289	550	550	998	1,548	940	2,003	2,943	1,838	3,387	5,225
	243	275	518	523	926	1,449	1,915	1,553	3,468	2,276	2,849	5,625
Durham	..	2	2	1	11	12	8	11	19	9	24	33
Lancaster	6,419	5,261	11,680	16,855	20,365	37,220	34,071	94,655	68,726	60,151	62,264	122,415
Leicester	66	17	83	130	92	222	120	158	278	325	267	592
Middlesex	24	..	24	109	14	123	62	119	181	217	133	350
Nottingham	82	131	213	132	382	514	250	706	956	481	1,242	1,723
Stafford	33	68	101	95	237	332	152	392	544	315	742	1,057
	34	45	79	106	166	272	257	313	570	434	557	991
York, West Riding	529	533	1,062	1,632	2,031	3,663	2,537	2,773	5,310	5,187	5,724	10,911
Total	9,196	7,865	17,061	23,974	29,869	53,843	50,675	53,410	104,085	87,875	94,217	182,092

Mills and Factories in which the Machinery is worked by Mechanical in the Northern half of Ireland (North of the county of Dublin), in the moreland, and the North-east angle of Yorkshire, being the district assigned

Counties.	Manufacture. Cotton.	Wool.	Flax.	Silk.	Total.
Lanark	74	2	..	2	78
Renfrew	41	2	2	4	49
Ayr	1	21	..	..	22
Bute	2	..	..	..	2
Dumbarton	4	1	..	..	5
Stirling	4	6	..	..	10
Clackmannan	..	17	..	..	17
Linlithgow	1	2	1	..	4
Edinburgh	..	..	3	..	3
Fife	..	1	46	..	47
Forfar	..	..	80	..	80
Perth	1	4	14	..	18
Kincardine	..	1	9	..	10
Aberdeen	4	6	4	..	14
Selkirk	..	11	..	..	11
Roxburgh	..	12	..	..	12
Dumfries	1	2	..	..	3
Kirkcudbright	1	..	..	..	1
Wigton	..	1	..	..	1
	134	86	159	6	388
Antrim	10	..	11	..	21
Derry	1	..	..	..	1
Down	3	..	1	..	4
Armagh	*1*	..	*5*	..	*6*
Meath	..	..	1	..	1
Mayo	1	..	..	..	1
	16	..	18	..	34
Cumberland	12	12	7	..	31
Northumberland	..	3	3	..	6
Durham	..	5	6	1	11
Westmoreland	..	1	..	..	1
Yorkshire*	..	..	3	..	3
	12	21	19	..	52

* No Return from a Mill near Gisborough.

Power, engaged in the Manufacture of Cotton, &c. in the whole of Scotland, counties of Cumberland, Northumberland, and Durham, a part of West- to Leonard Horner, Esq., Inspector of Factories, as reported in July, 1834.

Moving Power.			Total of Persons employed in the Factories.	Of whom, of Thirteen and under Eighteen Years.			Of whom under Thirteen Years.		
Steam.	Water.								
Total of Horses.	Total of Horses.	Together.		Male.	Female.	Total.	Male.	Female.	Total.
2,394	520	2,914	17,949	1,345	3,702	5,047	756	895	1,651
550	650	1,200	7,615	722	1,759	2,481	304	706	1,010
146	365	511	1,271	91	147	238	111	150	261
10	60	70	499	65	110	175	30	57	87
90	244	334	1,339	163	227	390	89	116	205
48	479	527	1,615	151	306	457	148	206	354
..	154	154	540	100	51	151	28	49	77
32	45	77	153	17	28	45	19	23	42
48	36	84	360	15	90	105	7	32	39
355	389	744	2,669	126	610	736	79	220	299
1,166	315	1,481	5,701	405	1,174	1,579	471	470	941
..	432	432	1,457	136	281	417	137	114	251
..	67	67	174	11	34	45	3	9	12
473	598	1,071	4,363	315	1,216	1,531	263	523	786
..	161	161	258	56	8	64	38	26	64
..	189	189	545	58	131	189	49	65	114
18	86	104	199	18	32	50	15	15	30
..	20	20	92	..	15	15	3	..	3
..	12	12	26	5	1	6	2	..	2
5,330	4,822	10,152	46,825	3,799	9,922	13,721	2,552	3,676	6.228
642	275	917	3,887	358	1,075	1,433	114	181	291
..	15	15	82	11	29	40	2	2	4
91	86	177	710	115	134	249	36	33	69
..	126	126	574	39	165	204	17	37	54
..	36	36	107	2	33	35	1	4	5
..	9	9	35	..	4	4	..	..	..
733	547	1,280	5,395	525	1,440	1,965	170	257	427
136	270	406	2,147	227	479	704	97	83	180
76	54	130	387	26	67	93	7	43	50
214	102	316	1,277	55	220	275	79	72	151
..	7	7	17	..	1	1	6	..	6
36	..	36	132	11	35	46	18	13	31
462	438	895	3,960	319	800	1,119	207	211	418

REPORT OF DR. KAY OF MANCHESTER TO THE COMMISSIONERS UNDER THE POOR LAW AMENDMENT ACT, 22d JULY 1835.

Quantity of Steam Power recently erected, but not supplied with Hands, or which is ordered and will be in Operation in a Year and a Half or Two Years, in the Cotton District of Lancashire and its immediate Vicinity.

Miles Distant from Manchester to Town, &c.	Name of Town, Township, or Parish, which form the Centre of the District so called.	Number of Firms to which the Power is to be supplied	Number of Horse Power.
6	Township of Hyde	9	486
8	Ashton and Dukinfield	8	640
7	Stayley Bridge	9	606
20	Saddleworth (Greenfield)	1	60
5	Stockport	17	936
11	Rochdale (district)	16	660
8	Heywood	3	78
12	Spotland	1	50
14	Bagslate	1	60
6	Birch	1	10
18	Accrington	1	50
10	Bolton (district)	19	755
12	Leigh	2	50
13	Horwich	2	175
20	Wigan	6	325
9	Bury	4	120
17	Haslingden	2	70
25	Burnley	7	241
26	Bacup (district)	8	196
20	Todmorden	7	285
30	Colne	3	100
30	Preston	10	422
12	Longdendale, near Mottram	4	70
20	Blackburn	4	280
20	Chorley	1	60
20	Bollington, near Macclesfield	1	60
17	Glossop-dale	7	187
	Manchester	12	395
	Oldham	3	60
	Total Horse Power	..	7,507

From the preceding Table it appears that 7,507 horses' power will be erected, and, if possible, brought into opera-

tion in the cotton district of Lancashire in the course of the next two years. One only doubt affects the limit of the period when this power will be in full operation, and this arises from the difficulty of supplying, in that time, even with the utmost exertion of every mechanist in the trade, the machinery which this prodigious force is intended to move. The impossibility of accomplishing this will, in the opinion of some of the most experienced manufacturers, delay the period when this vast accession to the trade will be in full employ.

Within whatever period this power is brought into complete activity, (calculating on an extensive average of mills in different departments of the trade,) six "mill hands" at least will be required for every horse-power, or the introduction of this power presupposes the employment of 45,042 "mill hands;" and if we take into account the unemployed members of the families of "mill hands," as well as mechanics, labourers, handicraftsmen, warehousemen, dyers, calenderers, finishers, shopkeepers, &c. &c. &c., in fact the whole population necessary to complete the social fabric of which these 45,042 "mill hands" will form a part, we must add an equal number.

This steam power will, therefore, place in immediate relation with itself a population of 90,084.

The outlay in buildings and machinery necessary to bring this horse-power into operation may be safely estimated at £500 per horse-power, without taking into account the capital necessarily employed in trading transactions in connexion with the power; or, in other words, the erection of this power presupposes an outlay of £3,753,500 in buildings and machinery, and which outlay we have shown will occur in the cotton district of Lancashire within two years.

END OF VOL. I.

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